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FLIGHT

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The Mysterious Stranger . . .

THE incident of the U-2 will loom in history as a towering monument to governmental deceit and ineptitude. Whether the repeated intrusion of these aircraft over Soviet territory is considered morally justifiable, or whether it is seen as an affront to human decency, the handling of the whole affair can only be viewed as a blunder of colossal stature—a Pentagonal plinth with a Capitoline pillar balanced on the brink. Nor is the fumbling and evasion America's alone. The scene in the House of Commons last week—"Storm Over U-2 Flights," "Debate Refused," "Wrangle Over U-2 Questions," "Is Macmillan Ashamed of the U-2 Truth?", the headlines ran—was one of the least edifying aspects of the British political scene.

The rumpus began when the Under-Secretary for Air refused to confirm or deny a statement that U-2 flights have taken place from Lakenheath. Commenting, the *Daily Telegraph*'s Washington correspondent suggested that the Opposition's attacks on the Government were based on a misunderstanding, and that the flights in question were weather missions. Be that as it may, the fact remains that from the earliest days of its operation from Lakenheath the U-2 was in the toils of American "security." No pictures or details were allowed to appear, although the aircraft was seen and accurately described by *Flight* readers. Nor were Lockheed, the makers of the aircraft, allowed to extend their customary invitation to the world to look to them for leadership in this new and sinister field. And sinister it was certainly allowed to appear. An editorial on this page over four years ago (June 1, 1956), calling attention to "the mysterious stranger," concluded: "Another thrilling instalment next week?".

More Instalments

The second instalment actually came out in *Flight* of July 6, 1956, when, again in an editorial, we wrote:—

"Regardless of the fact that any uncommon, unorthodox aircraft must inevitably excite comment and become news, somebody somewhere is evidently determined to maintain 'security.' The presence in the United Kingdom of one or more aircraft answering to the description of the U-2 was strongly implied in *Flight* of June 1 last, and since that date evidence has been accruing which inclines us yet more strongly to that belief. Indeed, we find ourselves so goaded by events, rumours and reports that we now propose to flaunt the T.S.C.s [top security chiefs] in an even naughtier and more deliberate fashion. This we shall do by presenting a cold collation of known facts and near-certainties."

We then proceeded to do as stated. Several reports from the Lakenheath area were mentioned and one sentence read: ". . . official photographs and technical particulars are rigorously banned by the US Air Force."

The top security chiefs were really enjoying themselves.

The third instalment came in *Flight* of November 23, 1956, when we printed a photograph together with these words: "This may confidently be supposed to depict the Lockheed U-2, of which no picture has hitherto been published, at the behest of the United States Government and of the Lockheed Aircraft Corporation." In the very same issue a reader reported having sighted a U-2 in the Farnborough area.

And so the fantastic story continued on to its world-shattering climax. A U-2 lies in pieces. Its pilot lies in prison. A Summit lies in ruins. Questions are being asked in the House.

FROM ALL QUARTERS

RB-47 "Shot Down"

ON Monday night Moscow Radio revealed knowledge of the USAF Boeing RB-47 missing since July 1, claiming that it had been shot down by a Soviet fighter over Russian territorial waters in the Barents Sea, and stating that two members of the crew of six officers had been rescued and would be tried. In Moscow, notes of protest were handed to the US, British and Norwegian envoys (as we reported last week, the aircraft had taken off from Brize Norton in Oxfordshire and the search had been based on Bodø). It was claimed that the RB-47 was armed and carried "special photographic and radio electronic intelligence apparatus." The news comes as this page closes for press, and after our leading article on the U-2 flights had already closed.

Gnat Trainer Ordered

AN initial production order for 30 Folland Gnat Trainers for the RAF was officially announced late last week. A pre-production batch of 14 was ordered in March 1958, and five of these have already flown. The last should be completed by next May and the first aircraft should reach the RAF late next year. Production rate is to be four per month. The Gnat Trainer will provide advanced training between the Jet Provost basic stage and a two-seat version of the operational type for pilots destined for fighter squadrons. It is powered by a Bristol Siddeley Orpheus 100 giving 4,230lb thrust.

Co-operative VTOL Programme

A SPOKESMAN of the West German Defence Ministry announced in Bonn on July 8 that the United Kingdom is to join West Germany, France and Italy in developing a VTOL ground-support and reconnaissance aircraft. The new machine is intended to supersede the Fiat G.91 "by 1965 at the earliest" and to have "near-supersonic" speed.

Last April the British Minister of Aviation, Mr Duncan Sandys, held discussions with several European defence and aviation chiefs—including Herr Strauss, West German defence minister—when it was stated that a joint project would be undertaken. Already German technicians have visited Short & Harland at Belfast to investigate the SC.1 autostabilization system, and at least six VTOL military projects are active in Europe. The only one in the hardware stage is the Hawker P.1127, powered by a Bristol Siddeley turbojet with swivelling nozzles. The remaining projects, for several years later, include schemes by Nord, Sud, Dassault, Messerschmitt and other French and German groups. Whatever design is chosen it is certain to be broken down into portions which can be shared internationally.

RNZAF Canberras

ON July 1 the New Zealand Minister of Defence, The Hon Philip Connolly, claimed that, ten days previously, he had discovered that the Rolls-Royce Avons in the 13 English Electric Canberra B(I).12s bought for £2.6m by the previous NZ Government were "secondhand," and that two had to be sent to Australia for repairs. But a week later he retracted, confirming the statement of the British Air Ministry that the aircraft conformed to the specification laid down by New Zealand, and were accepted "in full knowledge of the facts"; the sale was a government-to-government deal.

New Guild Liverymen

WHEN the Duke of Edinburgh, as Grand Master of the Guild of Air Pilots and Air Navigators, presided for the first time at a meeting of the Court—on July 7—he invested eight new liverymen. They were Marshal of the RAF Sir Dermot Boyle and Air Chief Marshal Sir Ralph Cochrane; Lord Knollys, chairman of Vickers Ltd; Mr Basil Smallpeice, managing director of BOAC; Capt L. R. Ambrose, Qantas representative in Europe and a former airline pilot; Mr Peter Masefield, 1959-60 president of the Royal Aeronautical Society; Capt A. G. Egerton, a BOAC pilot; and Mr Tom Brooke-Smith, chief test pilot, Short Bros & Harland Ltd.

The Duke was received by the Master of the Guild, Dr Kenneth Bergin.

Science Minister at Cranfield

THE need for a greater output of scientific and technological graduates in this country was stressed by Lord Hailsham, Minister for Science, at the College of Aeronautics, Cranfield, on Friday, July 8. Speaking at the annual presentation of diplomas and prizes at the college, Lord Hailsham said that there was a requirement for twice as many graduates in these fields as at present. The main danger in specialization was that the specialist might not relate his own experience to the overall scene and wider human requirement which was changing so drastically at the present time.

The awards included 73 College diplomas for the two-year post-graduate course, eight advanced engineering diplomas for one-year courses in diversified subjects, and 25 guided-missile course certificates. Special awards included the Governors' Prize and SBAC Prize in aircraft design to D. M. Richards; Principal's Prize, T. N. Stevenson; Woods of Colchester Prize in aerodynamics, A. J. W. Smith; SBAC Prize in aircraft propulsion, Flt Lt D. W. Richardson; and Royal Aeronautical Society Prize, J. B. Hargrave.

"Flight" photograph

PITCH UP: Brian Neely, more accustomed to turbojet power, becomes embarrassed by his propeller while lifting his Proctor's tail against the brakes at the start of the King's Cup. The event is reported on page 80

PRESERVED: Biggin Hill, now world-famous for its part in the Battle of Britain, is to have a permanent museum of wartime aircraft. It will be housed in one of the hangars used by Spitfires and Hurricanes in 1940. Fitters are seen at work on an Me109E, and in the background is an He111

Filton Changes

AS a consequence of his appointment as BOAC chairman, Sir Matthew Slattery has tendered his resignation from the board of the Bristol Aeroplane Co Ltd and of its associated company Bristol Aerojet Ltd.

It is also announced from Filton that Mr W. R. Farnes, OBE, sales director of Bristol Aircraft Ltd since 1957, has resigned from the board of that company and been transferred to the Bristol Aeroplane Co Ltd for duties connected with its other interests. He has been appointed a director of Bristol Aerojet Ltd (in succession to Sir Matthew Slattery) and managing director of Bristol Aeroplane Plastics Ltd, one of the subsidiary companies created by the Bristol Aeroplane Co following the transfer of Bristol Aircraft Ltd to the British Aircraft Corporation.

Mr Farnes, who joined Bristol in 1946 after service in the RAF, was responsible for co-ordination of the Brabazon project. Later, when that project was transferred wholly to the aircraft division (as it then was), he became personal assistant to Mr C. F. Uwins, at that time managing director of the aircraft division. He became sales manager of the division in 1950 and in January 1957 was appointed sales director of Bristol Aircraft Ltd.

EASY MAINTENANCE of the Grumman AO-1 Mohawk all-weather army observation aircraft is typified by this "exploded" view. The turboprops are Lycoming T53-L-3s of 1,005 e.h.p.

Lightplanes at Venice

AMONG the surprises of the 8th International Air Show held at the Lido, Venice, last week was the first appearance in Western Europe of new aircraft designed and built in Yugoslavia. One of them, the UTVA 56 general-purpose monoplane, was known to be under test. The other, designated V.55, is a hitherto-unreported tandem two-seater, rather like a Piper Cub in appearance and intended for club flying and glider towing.

Seventeen light aircraft from six countries took part in the flying display, and were followed on the last of the three days by an Italian Air Force four-man aerobatic team in F-86F Sabres. The home industry was represented by such newcomers as the low-wing Aviamilano P.19 Scricciolo and high-wing Partenavia P.59 Jolly, which are in competition as standardized equipment for Italian flying training schools, and the Lualdi L.59 helicopter.

Fiat, although not eligible to take part in the flying display, put on an exhibition of models and photographs of the G.91 and Model 7002 helicopter, and released some official details of their forthcoming G.95 STOL development of the G.91. Utilizing a patent held by Ing. Giuseppe Gabrielli, this single-seat fighter will have two Rolls-Royce lightweight turbojets angled at 30° to the fuselage datum, one each side of the main Orpheus jetpipe.

Other new types of which preliminary details were made available include a four-seat version of the Klemm Kl 107, the Legrand-Simon L.S.65 STOL two-seater and the Yugoslav CA.51 lightplane with converted Volkswagen engine.

It is hoped to include a report on the show and on progress at Venice's new Marco Polo Airport in next week's *Flight*.

History at Bristol

THE display held by the Bristol branch of the Royal Air Forces Association at Filton last Saturday proved to be (writes a correspondent) one of the most interesting and varied displays ever seen in the West Country. One of its aims was to mark the 50th anniversary of the Bristol Aeroplane Co Ltd by exhibiting early as well as modern aircraft.

Five veteran machines were in fact on show to the large crowd. Bristol Fighter D8096 (1917), Avro 504K E3404 (1915), Sopwith Pup N5180 (1916) and SE.5a D7000 were all flown; and the reconstructed Bristol Bulldog (G-ABBB) was shown statically—it is hoped that it will be flying in a week or so.

Modern aircraft were very much in evidence, with displays by No 111 Squadron's Hunters, the Skyblazer's Super Sabres, the CFS Jet Provost team, a USAF flight refuelling team (KB-50J, B-66, F-100 and F-101), and Valiant, Britannia, Shackleton MR.3, Whirlwind, Sycamore, Chipmunk and other types.

In the static display was Britannia Type 305 9G-AAG (picture, page 100), which is shortly to be delivered to Ghana Airways. The bright colour scheme of red, blue, yellow, white and black has to be seen to be believed. It certainly will not pose any problem for the recognition enthusiast.

Good Show at Lille

THIRTY THOUSAND people watched a four-hour air display at Lille/Bondues on July 3, when 30 events were flown in an excellently timed programme. The meeting was organized by the Meetings Nationaux de l'Air, director-general of which is the energetic Gen P. Bodet. There were fly-pasts by the local aero club and some highly exciting parachuting from a Noratlas, but the highlights were undoubtedly the performances by No 111 Sqn, the 12 Mystères of the Patrouille de France led by Capitaine Castagnos, and formation aerobatics by five Fouga Magisters of the Salon de Provence school, commanded by Lt Angot.

Treble-One began with a 16-Hunter loop in "pterodactyl" formation, with smoke, after which the two reserves broke away and the rest split into a nine (led by Sqn Ldr Peter Latham) and a five (Flt Lt "Chas" Boyer) for the now familiar but no less exciting co-ordinated show which brought the crowd to its feet for prolonged applause.

A Valiant of No 207 Sqn, RAF, having flown from an earlier show at Buchel, made stately but restrained circuits before returning to Marham. Léon Biancotto (Nord 3202) and le Chevalier d'Orgeix (Stampe SV.4) put their aircraft into all attitudes; the Belgian Air Force provided a show with four Hunters; and four Stampes from St Yan, led by M le Chevalier, showed that formation aerobatics in low-powered biplanes are as lovely as ever. Lt Bernard Vouaux flew a Vatour with marked effect, and the ancient Caudron chugged happily across the aerodrome.

The Mystères' performance was as tight and smooth as any, perhaps a little slower than Treble-One, and using much more sky. They closed the meeting with three of them making a circle of the airfield with pretty but expensive tricolour smoke; precisely as the ring was completed the remaining nine bomb-burst downward through the centre—a manœuvre much appreciated.

NEW CONFIGURATIONS of Westland helicopters. Upper, the Westminster G-APLE (two Napier Eland) in its recently covered-in form. Lower, a Wasp carrying two dummy torpedoes under the centre-section. The Wasp is being evaluated by 700X Squadron at Yeovilton

IN BRIEF

Saab, it is reported, are negotiating with Saunders-Roe for production of hovercraft in Sweden. Interest is in 125-ton vehicles for use between Sweden and Denmark.

Mr Duncan Sandys, Minister of Aviation, confirmed this week that financial support will be available for the D.H.121, AW.650 Argosy and VC10. He also included the Super VC10. Asked about supersonic airliners he said, "We are very far advanced on studies of two projects."

Nord-Aviation announced on July 7 that US General Electric have acquired the option to manufacture SS.10 and SS.11 missiles in America, with the US Government having the right to establish a second source should the need arise. Nord missiles are featured on pages 83-86.

The Woburn Abbey aerial "at home" planned for next Sunday (July 17) has had to be postponed, and the landing strip will not be open to visitors on that date.

HMS *Lincoln*, fourth of the Salisbury class aircraft direction frigates, was accepted for service from her builders—the Fairfield Shipbuilding and Engineering Co Ltd—at their Govan (Glasgow) shipyard on Thursday last week.

Index Aeronauticus, the MoA abstract of the world technical press on aeronautics and astronautics which was previously issued as a free service, is to be on sale to subscribers from this month's (July) issue. Subscription is £5 5s per year or 8s 6d for single copies, both prices including postage.

A 1932 Blackburn B.2 trainer piloted by Lt Cdr Derek Whitehead, chief test pilot of Blackburn Aircraft Ltd, landed on the sands at Filey on July 12 to commemorate the 50th anniversary of the commencement of flying there. In addition there was a helicopter demonstration and two sticks of paratroops dropped into the sea from a Blackburn Beverley of RAF Transport Command.

Cairo Radio reported recently that a U-2 was forced to land at Khartoum Airport owing to engine trouble. The report added that "after repairs it took off and disappeared in the direction of Nairobi." In a July 3 report Peking Radio alleged that an American weather station near Alice Springs in Australia was in fact a U-2 base, "frequently visited by American espionage VIPs."

Climax at Coventry

RACES, AEROBATICS, PAGEANTRY

King's Cup finds a Royal Winner

Great day for the two Turbulents—they finished first and second in the King's Cup. John Severne (foreground) passed Clive Francis on the third lap and led him home by 51 seconds

"FLIGHT" PHOTOGRAPHS

IT had all the proper ingredients: those little yellow pylons which William Faulkner immortalized in a novel; tents and caravans bulging with competitors and non-combatants; a hundred or more light aircraft of every make and vintage; Royal Aero Club officials loaded with badges and arm-bands and businesslike expressions; a Coventry bookmaker shouting the odds on the King's Cup; and a cumulus-laden summer sky alternately dispensing sunshine and rain: all adding up to the Coventry Air Pageant, National Air Races and Lockheed International Aerobatic Competition at Baginton last Saturday.

Both before and after the air races and finals of the aerobatic competition there was a varied flying display, ranging from the magnificent Hunter groupings of Treble-One Squadron to joyous individual antics by Ranald Porteous in the smart new be-spatted Auster Aiglet, from the lordly posturings of a Valiant and a Britannia to silent manœuvrings by red Olympias of the Coventry Gliding Club.

All this amounted to a sky virtually gyrating with aircraft from morning (when the King's Cup competitors were practising) till evening, and it says much for the day's organizers that everything went pretty well to schedule. The weather was continually uncertain, but only once (around 3 o'clock) did a really heavy shower drive spectators to shelter; for the rest of the time there was a continually changing cloud background, with a ceiling that never came too low to incommode proceedings. Timings were good (Treble-One, for example, arriving immediately the King's Cup Race finished and in a burst of brilliant sunshine) and John Blake of the RAeC kept up a well-informed and fluent commentary, being given a deserved break during the Treble-One and CFS Jet Provost items, which were described by their own commentators.

"Flight" Gemini's-eye view of Crabtree's Gipsy-Gemini pulling into the vertical for the Hunningham turn

Royal cup for royalty's pilot: victor's laurels are bestowed on John Severne by Ald Mrs Pearl Hyde, chairman of the organizing committee

The Jet Provosts, while less spectacular than the 16 Hunters, owed them nothing in the matter of precision flying; and their fluorescent surfaces and flame from their smoke cartridges stood out strikingly against the dark clouds. USAF aircraft also contributed to the display, with a KB-50J/Destroyer/Voodoo/Super Sabre air-refuelling demonstration and a fly-past by T-33s. A Chipmunk of Nottingham UAS flown by Flt Lt G. M. Cullen, gave three excellent aerobatic performances; and low-level aerobatics (including an inverted circuit at 300ft) were brilliantly displayed by Peter Phillips in the Bishop Tiger G-ANZZ.

During the morning, a bulldozer chewed nonchalantly away at the red earth where Baginton's new runway is to be; and in her remarks at the end-of-the-day prize presentation Alderman Mrs Pearl Hyde, chairman of the Coventry Aerodrome Committee, referred with pride to next year's pageant—"when the runway is going to be finished." Certainly all those who contributed to the 1960 display deserve the thanks of 100,000 spectators (or however many the final tally reckoned): for the variety and movement were continuous and exciting, and the flying standards high. H. W.

The King's Cup

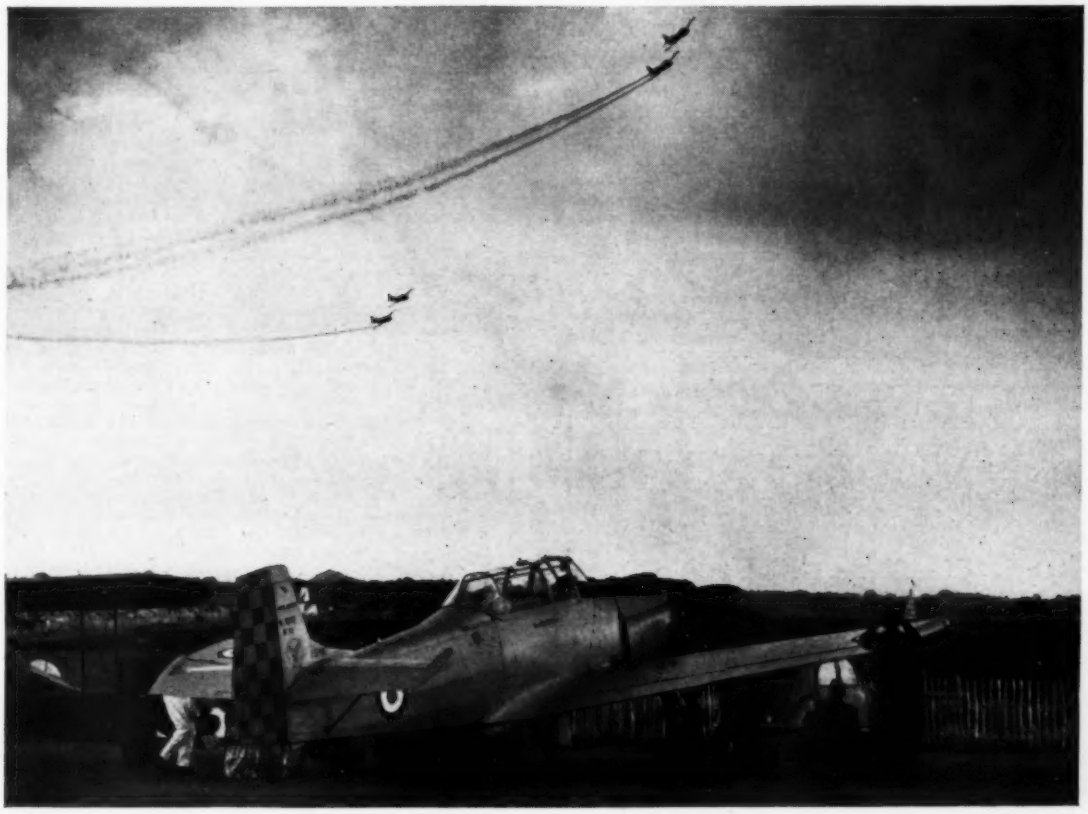
Under the "power bulge" on the cowling of John Severne's white Turbulent G-APNZ is a twin-choke Solex carburettor. This, coupled with Porsche cylinder heads, careful port-polishing and tuning by Derrington and *selective* aerodynamic modification was one of the major factors that enabled him to win for the Duke of Edinburgh the 28th King's Cup Air Race. He led the second man home, Clive Francis in the green Turbulent G-APZZ, by nearly a minute—this in spite of apparently throttling back on the last lap. Francis' triumph too was convincing; he led the pack—headed by Bailey's Magister—by another long interval of 54sec. The two Turbulents thus ran complete rings round the handicappers and everyone else. Undoubtedly a spot of gamesmanship in the eliminating rounds of the Nationals—flying at less than full throttle in the London - Cardiff and short circuit races at Rhoose—accounted for these runaway wins. While John Severne's victory was a most popular one, these tactics spoilt the race as a spectacle (the slide-rule and stopwatch men had confidently selected the winner on the second lap) and raised again the thorny controversy of whether or not to throttle-bend in eliminating heats. The remainder of the field finished pretty well *en masse*, with a very close race for third place.

Of the 21 competitors who faced the starter's flag all but Brian

Snook in the Archbishop (No 22) and David Phillips in the Linnet were matched to within half-a-mile an hour. The latter's duel with J. Stewart-Wood's Auste:—referred to below—was one of the highlights of the King's Cup

Neely got cleanly away. With the throttle opened quickly, his Proctor lifted against the brakes and its propeller tips struck the ground. After the two Turbulents left at scratch (Francis) and 2min 22sec (Severne) respectively, Clive Elton, "Bish" Bishop and Sheila Scott were flagged off together, for a private race that was to last well into the third lap and involve a long battle with Geoffrey Marler's silver and red Jackaroo before the latter squeezed ahead on lap 3 and then built up a more commanding lead to finish fifth. Another race-long duel was fought out by John Stewart-Wood, winner of the London - Cardiff race and leader on points for the air-racing championship, and David Phillips in the Garland Linnet. Both started from the 9min 9sec mark and both slipped back slightly on handicap, but for the whole of the four laps neither gave an inch; Stewart-Wood's Auster gained three seconds on take-off and was chased thereafter by a grimly determined pilot in the Linnet. Cornering really steeply, close-in and very low the Linnet gradually made up lost ground on the slightly higher-flying Auster. On lap 2 their flying times were equal; on lap 3 Phillips picked up

Four Jet Provost T.3s from the RAF Central Flying School, led by Flt Lt Roy Langstaff, seen above the Nord 3202 of Leon Biancotto during their display of synchronized formation aerobatics. Cloud background typifies the conditions prevailing throughout most of the afternoon



Climax at Coventry . . .

0.8sec and on lap four—whipping even closer into the turns—he more than pulled back his three seconds to edge past the Auster and gain 1.4sec at the post.

While these individual nose-to-tail wingtip-to-wingtip battles were in progress the remainder of the field were condensing the 18½min that separated them at the start. At the end of the first lap Bailey's cream single-seater Magister had closed up appreciably on Jim Denyer's blue Auster; he slaughtered 25 of the 49sec separating them on the first time round and more than recovered the rest on lap 2. The Magister looked very fast and Bailey's flying of it was strikingly consistent; on the two complete laps only 0.2sec separated his lap times. And if this is a reliable standard of pilotage skill then Spiller (6min 53.2sec and 6min 53.2sec), Stewart-Wood (8min 18.8sec and 8min 18.6sec), Francis (10min 4.2 and 10min 4.8), and Sheila Scott (9min 39.4 and 9min 39.6) must be included too.

Spiller was another pilot whose mount, Proctor 3 G-AHEK, looked a promising early finisher as he rounded the aerodrome pylon for the first time. The slowest of the three Proctors, he was clearly staving off the challenge from Watson and Buster Paine. Blamire, on the other hand, had improved on his handicap to an extent exceeded only by the two Turbulents. His exquisitely finished bronze Gemini seemed never to have gone better. He overhauled poor Crabtree (who had changed piston rings on one cylinder that morning) out near the Brandon turn the first time round, and before the first of the 17-mile laps was completed the Blamire Gemini—sounding wonderfully crisp and potent—was establishing a commanding lead.

Now the potential early finishers were becoming more obvious. Round the aerodrome pylon for the second time the issue of third, fourth, fifth and sixth places was still in doubt, but as the field began to bunch on the end of the third lap it was Severne and Francis, and then Beverley Snook in the Archbishop Tiger, Bailey, Spiller, Marler and Blamire who were picking up places and precious seconds. Crabtree passed through, trailing the field but still in the running, and the crowds at Baginton settled down to wait. It was gin-clear under a stormy sky and the air was still and silky smooth.

Unheralded, with no other aircraft in sight, the royal-crested white Turbulent sped across the finishing line. A mile and a half behind him Francis was on his way from the Brandon turn; the rest of the field were rounding the pylon. Over came Francis and then—the deluge: Bailey and Spiller nose-to-nose, tip-to-tip and spat-to-spat. They were, it seemed, right on the deck, but pushing in even lower was Marler's Jackaroo, and breathing on his neck Watson's Proctor (in an astonishing longer last lap Watson equalled his third-lap time, one of only three competitors to do so), Percy Blamire's Gemini and Snook's Tiger. One minute 45.2sec separated the first three; 1min 21.2sec all the rest of the field.

How was John Severne able to win so handsomely? Unquestionably his preparation was meticulous; every aerodynamic modification had been most carefully tested and included only if its racing value was proved. But his Turbulent was not much more modified than that of Francis except for its carburation and it seems that at Rhoose the handicappers severely underestimated the quite well-known benefits to the Volkswagen engine of improved breathing. Perhaps they had forgotten too the startling effect of just the same Ford V8 carburettor, properly tuned, on Colin Chapman's early Lotus Austin 7s. All that is academic now. The question is: Will John Severne be handicapped to win any air race in a Turbulent ever again?

A. T. P.

KING'S CUP AND CHAMPIONSHIP PLACINGS

Pos	Pilot	Aircraft	Regis'n	H'cap min/sec	Speed (mph)	Points NAR‡	Points †KC	Points Total
1	J. Severne*	Turbulent	G-APNZ	02 19	105½	54	21	75
2	C. P. Francis	Turbulent	G-APZZ	00 00	97½	40	20	60
3	W. H. Bailey	Hawk Tr.	G-AIJA	11 49	133	40	19	59
4	A. J. Spiller	Proctor 3	G-AHEK	13 25	140½	38	18	56
5	G. Marler†	Jackaroo	G-APAP	04 00	105	56	17	73
6	G. P. Watson	Proctor 3	G-AOEJ	14 34	145	48	16	64
7	P. Blamire‡	Gemini 3C	G-ALZG	18 13	166½	46	15	61
8	B. J. Snook	Tiger Moth	G-ANZZ	08 04	117	50	14	64
9	A. S. K. Paine	Proctor 1	G-AHNA	15 43	149½	44	13	57
10	L. J. Benjamin	Tiger Moth	G-AOAA	07 56	115½	36	12	48
11	C. A. N. Bishop	Tiger Moth	G-ACDC	03 40	102	44	11	55
12	Miss G. M. Cazalet	Tiger Moth	G-APNK	06 22	109½	42	10	52
13	C. E. Elton	Tiger Moth	G-ARAZ	03 40	102	40	9	49
14	C. Gregory	Taylorcraft Plus D	G-AHGZ	06 31	109½	42	8	50
15	D. W. Phillips	Linnet	G-APNS	08 57	117½	24	7	31
16	R. W. Bowles	Auster 6	VF-544	10 35	123½	48	6	54
17	J. Stewart-Wood	Auster V	G-AIKE	08 57	117½	62	5	67
18	J. H. Denyer	Auster J1.N	G-AJEH	11 02	124½	36	4	40
19	Miss S. Scott	Jackaroo	G-APAM	03 40	101	56	3	59
20	E. Crabtree	Gemini 3C	G-AKEG	17 55	158	30	2	32
—	K. B. Neely	Proctor 3	G-AOGE	15 23	Retired	30	—	30

*British Air Racing champion. †Runner-up. ‡SBAC Challenge Cup for fastest aircraft. §National air races.

Left, Juraj Souc of Czechoslovakia, second in the Lockheed contest, receives his prize from Mrs Pearl Hyde. Right, Leon Biancotto of France, in third place, received the winner's replica on behalf of compatriot Jean d'Orgeix, who left immediately after the contest

The Aerobatic Contest

SIXTEEN pilots from five countries entered for this year's aerobatic competition for the British Lockheed Trophy. From the original list of 20, four had withdrawn: these were Frank Price and Lt Chandler (USA), Madame Cormouls-Houles (France) and Maj Liardon (Switzerland). This left five from Britain, five Czechs (two of whom were women), four French, one German and one Swiss.

This list was whittled down to four Czechs and three French following the eliminating round on Friday. Once again the British pilots had been hampered by unsuitable aircraft, but Ayers and Phillips (Tiger Moth) and Lane (Currie Wot) put up extremely worthwhile performances.

Under a low, dark cloudbase G. J. Verette in his grey Stampe was first to perform. The familiar French quality unfolded—outside loops, outside vertical figures-of-eight, slow and hesitation rolls, with some neat 90-degree linking changes. It seemed a sequence of good but separate patterns rather than a single design.

Zdenek Beseda of Czechoslovakia was next, his trim Zlin cutting an altogether crisper figure which included a tailslide—a Czech speciality which each of his compatriots was to repeat. Fast, firm rolls and no-nonsense loops—this was strict-tempo flying by a pilot who had the verve to get away with an inverted signing-off wing-waggle.

Jirina Lockerova, 20-year-old factory clerk, was the first of the Czech girls to perform. The most striking feature of a competent show—and in this company "competent" implied a high quality—was a superb climbing 2½-roll followed by two impeccable bunts.

Next came the yellow-and-black Stampe flown by Chevalier Jean d'Orgeix. This was artistry in flying from the inverted spin which opened the show to the hesitation roll which ended it. In between we had a varied mixture of lazy upward rolls, crisp snaps, bunts and inverted stall turns, and a beautiful complete rolling circle—rolling right and turning to the left.

Juraj Souc, flying the only Trener in the finals, competed with a heavy rainstorm during his display. Originality seemed high here, as the Czech pilot strung together a series of extremely complicated knots in the sky, all in the most spirited manner.

And now Leon Biancotto, three times winner of this contest. Not content to win in a Stampe or a Zlin—he has done both—this pilot had accepted the challenge again of a less-suitable aircraft. Last year it was the Archbishop Tiger Moth; this year the Nord 3202, a fully equipped military trainer. Somewhat Harvard-looking, and certainly Harvard-sounding, the yellow machine bored into a determined sequence of mainly inverted manœuvres, seeming to strain noisily in completing the more-demanding patterns which had come easily to the lighter, trimmer Stampes and Akrobats. Behind it all was the touch of the master.

The final contestant flew later in the display, following a regrettable mix-up in the timing of the overall programme. She was Eva Krencova in the cream Zlin Akrobat, and from the spectators' viewpoint she produced the most relaxed and stylish performance of all. No brand-new set of manœuvres, but a smoothly flowing whole. This 21-year-old clerk from Olomouc Aero Club certainly wrote the word aerobatics with a copperplate flourish over Baginton. Faulty positioning, however, reduced her marks.

The standard this year was higher than ever before, and the judges had an extremely difficult task in deciding between the finalists. Their verdict was that d'Orgeix of France was the winner; in their opinion his had been the most varied and smoothly executed display, with positioning that was well-nigh perfect.

In second place was Souc, who had ably demonstrated just about everything that a Zlin could do. A general comment was that the Czechs had concentrated on mainly vertical manœuvres, while the Stampes had used to the full the extra horizontal dimension. Only the Zlin Akrobats and Trener, however, had included the tailslide. The final order of placings was (1) d'Orgeix, (2) Souc, (3) Biancotto, (4) Beseda, (5) Krencova, (6) Verette and (7) Lockerova.

K. T. O.

Missiles and Spaceflight

A standard NATO ground-attack weapon system: the Fiat G.91R and two Nord AS.20s

The Nord Missile Family

With Special Reference to the Supersonic Members

NOWHERE in the West has the development and production of guided weapons been planned and executed with greater sureness and success than by Nord-Aviation SNCA, of Chatillon-sous-Bagneux, France. Nord have now evolved a family of weapons embracing four entirely different types of mission; yet each has led logically to the next, and all make use of common principles and techniques.

The family began with the SS.10 (SS=*sol-sol*, surface-to-surface). Having its inception in the German X-4 and other 1943-5 projects, its design was prepared shortly after the War under the direction of the late General Vernisse of the Arsenal de l'Aéronautique. The Arsenal later became SFECMAS, and finally merged with the SNCA du Nord. The SS.10 was built in quantity as the Nord 5202 (training) and 5203, and has been delivered in larger quantities than any other missile (over 30,000). It was fully described in our issue of February 7, 1958.

Like the pioneer X-4, SS.10 is steered by command signals transmitted from the launching point along fine wires unreeled from the missile as it flies. Control is exercised by means of vibrating spoilers at the root of the trailing edge of each of the four wings. The latter are mounted at a slight angle to the body axis so that the missile rolls throughout its flight. By this means a single reference gyro can be employed to index the pitch and yaw signals to alternate pairs of spoilers as they pass through the appropriate plane of demand. All four spoilers vibrate continuously and each control impulse causes a dwell, not an actuation, so that low-strength signals may be employed with little amplification. Propulsion is provided by a two-stage solid motor, the first charge giving high thrust for the boost phase.

While the SS.10 was in the final stages of development the same design team started work on a much heavier and faster missile designated SS.11, and with the company type-number Nord 5210 (described in our issue of November 14, 1958). The higher speed (see data table) necessitated the use of a new control system. Even if spoilers could have been fitted into the highly swept trailing edges, they would have had to operate in very disturbed air and could not have been made effective over the entire speed range of the weapon. Much research went into the perfection of an effective system, which forms the basis of the steering mechanism of all later Nord weapons. The command signals are passed to a quartet of jet spoilers which deflect the jet from the sustainer rocket motor to give a very powerful control.

Some seven years ago, in parallel with the SS.11 programme, attention was turned to the problem of developing a supersonic air-to-air missile with the same basic control concept. The SFECMAS/Nord group were awarded a government contract for it as the AA.20 (AA=*air-air*), and the basic missile was designated Nord 5103. Nord were entrusted with the entire weapon system, and its development quickly became the largest missile project within the company.

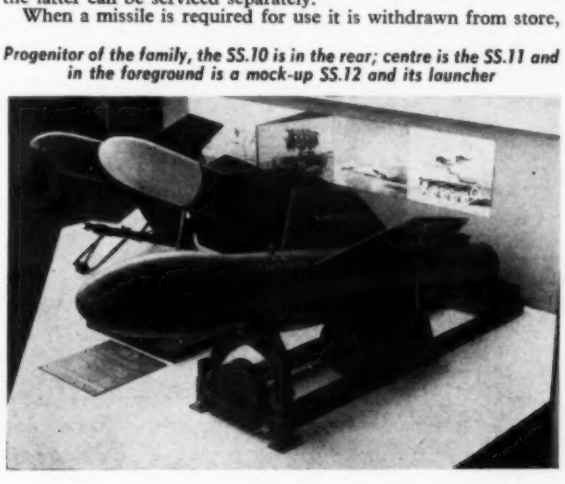
It is significant that those responsible for establishing the basic design parameters took care not to set their sights too high. Although the AA.20 was from the outset intended to be a fully effective operational missile, it was generally regarded as an interim missile pending development of the ultimate Matra 530 series, and so was never intended to be an "all-can-do" weapon. On the contrary, by setting fairly modest design targets, and in particular by adopting command guidance, the problems of development were minimized, operational delivery hastened and the versatility and flexibility of the final weapon system increased. As a result the AA.20 cannot be used at night or in bad weather, although developments overcome this limitation. On the other hand, as long as the target can be seen the missile can be launched against it, so that attacks can be made from any quarter and not only from astern or on a collision course. (It is instructive to compare the missile with our own Fireflash, which—as Blue Sky—was likewise conceived as an "easy" stop-gap while more advanced missiles came along behind.)

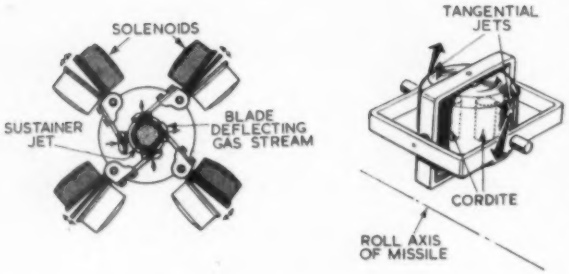
Notwithstanding its entirely different function, the AA.20 weapon system was based on that of the earlier anti-tank missiles, and the maximum use was made of the great fund of practical design experience which had already been obtained. Essentially the air-to-air missile is an enlarged SS.11 redesigned for supersonic flight. Naturally enough, wire guidance had to be replaced by radio command signals, but the pilot's controller is identical with that used by the operator of an SS.11. All portions of the weapon system carried in the parent aircraft are quite compact, and have an aggregate weight below 120lb. To describe the overall weapon system it is proposed to outline its method of operation.

Most AA.20s have been manufactured at Chatillon. After final acceptance tests, the two major portions (warhead and missile body) are packed one above the other in a rigid shockproof supporting frame, which is then inserted into a metal container and hermetically sealed. The warhead, occupying the upper part of the container, can be inserted and removed independently, and another compartment contains the airborne battery package so that the latter can be serviced separately.

When a missile is required for use it is withdrawn from store,

Progenitor of the family, the SS.10 is in the rear; centre is the SS.11 and in the foreground is a mock-up SS.12 and its launcher





Left, an end view of the jet-deflection system; the spoilers vibrate between pairs of solenoids. Right, the cordite-driven gyro

Missiles and Spaceflight . . .

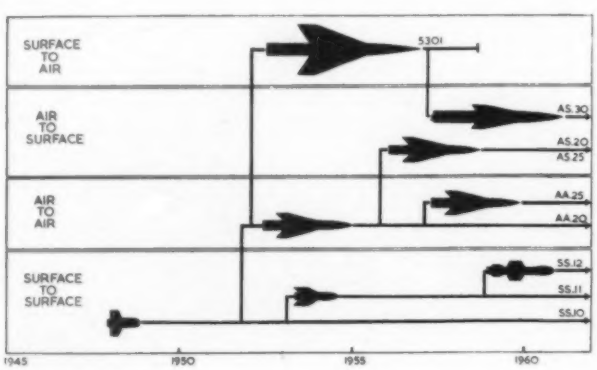
the warhead screwed on to the body and system checks made before attachment to the aircraft pylon. The latter supports the weapon via a zero-length lug near the c.g. and three axial spigots behind the wings. At the front of the launcher is a vertical screw for adjusting missile incidence, and the main attachment incorporates a pyrotechnic stop which is automatically ignited during the launch sequence or for emergency jettisoning. Minimum pre-launch warming-up period is two minutes, and in practice it is usual to switch on the heating system at take-off. In the cockpit are the missile pre-heat switch, safety (warning) switch, tell-tale lamp to indicate that the transmitter is ready, and sequence indicator (energized when the target comes within range). Once the last-named has triggered, the pilot can choose his own time for firing.

Fundamental to the guidance system is the fact that the pilot can simultaneously fly both the aircraft and the missile. For the latter purpose a miniature joystick is used to transmit pitch and yaw demand signals over a co-ordinating transformer which enables the missile to be controlled without reference to what the aircraft may be doing. When the pilot is ready he presses the launching switch in the cockpit, which fires the pyrotechnic stop to release the missile. The circuit also closes the main safety contact, ignites the missile's cordite-driven gyro and trace flare and finally fires the main boost motor. The latter reaches full thrust about one second after the cockpit switch is activated. The gyro accelerates almost instantaneously to 40,000 r.p.m.; it is then uncaged, and this action simultaneously uncages a free gyro in the parent aircraft which enables the pilot's control signals to be transferred from his own reference planes to those of the missile. A simple system permits the selection of any of a large number of discrete codes for the guidance transmitter, so that when several rounds are launched from a formation of aircraft each pilot can control only his own missile.

NORD MISSILES

	Function	O'all l'gth (in)	Span (in)	Laun. w'ght (lb)	Max flight speed (mph)	Max effect. range (ft)	Type of guid'ce	Type of control
SS.10	SSM/ASM	33.86	29.53	33	177	5,250	Wire	Spoilers
SS.11	SSM/ASM	46	20.47	63	426	11,490	Wire	Jet deflection
SS.12	SSM/ASM	75	32	150	400	21,000	Wire*	Jet deflection
ACAM	SAM	177	59	1,058	1,350	49,000‡	Radar	Jet deflection
AA.20	AAM	102	31.5	295	1,365	36,000†	Radio	Jet deflection
AA.25	AAM	102	31.5	298	—	—	Radar	Jet deflection
AS.20	ASM	102	31.5	317	1,365	—	Radio	Jet deflection
AS.25	ASM	98	31.5	317	—	35,000†	Radar	Jet deflection
AS.30	ASM	149	39.4	1,150	—	33,000†	Radar	Jet deflection

* Radio is alternative; † from point of launch (range ahead of aircraft is about 14,000ft but depends on aircraft speed and trajectory); ‡ altitude above launch.



The boost motor is fired electrically and exhausts through twin nozzles at the base of the weapon. Approximately one second after ignition a pair of pyrotechnic ball-relay time delays allow the boost-motor gas to ignite the sustainer. After one further second the boost charge burns out, but return flow of sustainer gas is prevented by the ball-relay valves. The sustainer has a star-centred charge, to give essentially constant-pressure combustion for some 20sec and thus maintain the missile at the speed reached at the end of the boost phase. The sustainer has a single nozzle on the axis of the missile, surrounding which are the four jet-deflection spoilers with which the missile is steered.

While the missile flies it rolls continuously, like the earlier Nord weapons, so that a single reference gyro may be used for both pitch and yaw signals. The roll is engendered by the four wings, which have acute sweep to maintain good stability during the transonic acceleration and also contribute to flight stability in the face of substantial c.g. changes as the propellant is consumed. Each wing comprises a pair of skins formed from light-alloy sheets bonded to either side of a wooden core. The long leading edge is sharp, the short trailing edge blunt and the root attachment is effected by countersunk screws passed through lugs in the main forged body sections. The centre body is machined from a high-strength forging, to bear the wing loads and motor combustion pressure.

Even when launched from a 1,000 m.p.h. aircraft the missile speeds ahead. The sustainer charge is virtually smokeless, and the pilot can readily align the trace flare with the target by using a graticuled optical sight. In order to keep the missile and target aligned with the pilot's eye, pitch and yaw demands can be imparted by suitable small movements of the controller joystick. The electrical signal is passed through the co-ordinate transformer, junction box, coder supply and modulator, and finally to the command-link transmitter aerial. The coded signals are picked up by the aerial mounted within the trailing edge of two of the wings of the missile, and thence through the airborne reference gyro to the jet-spoiler system.

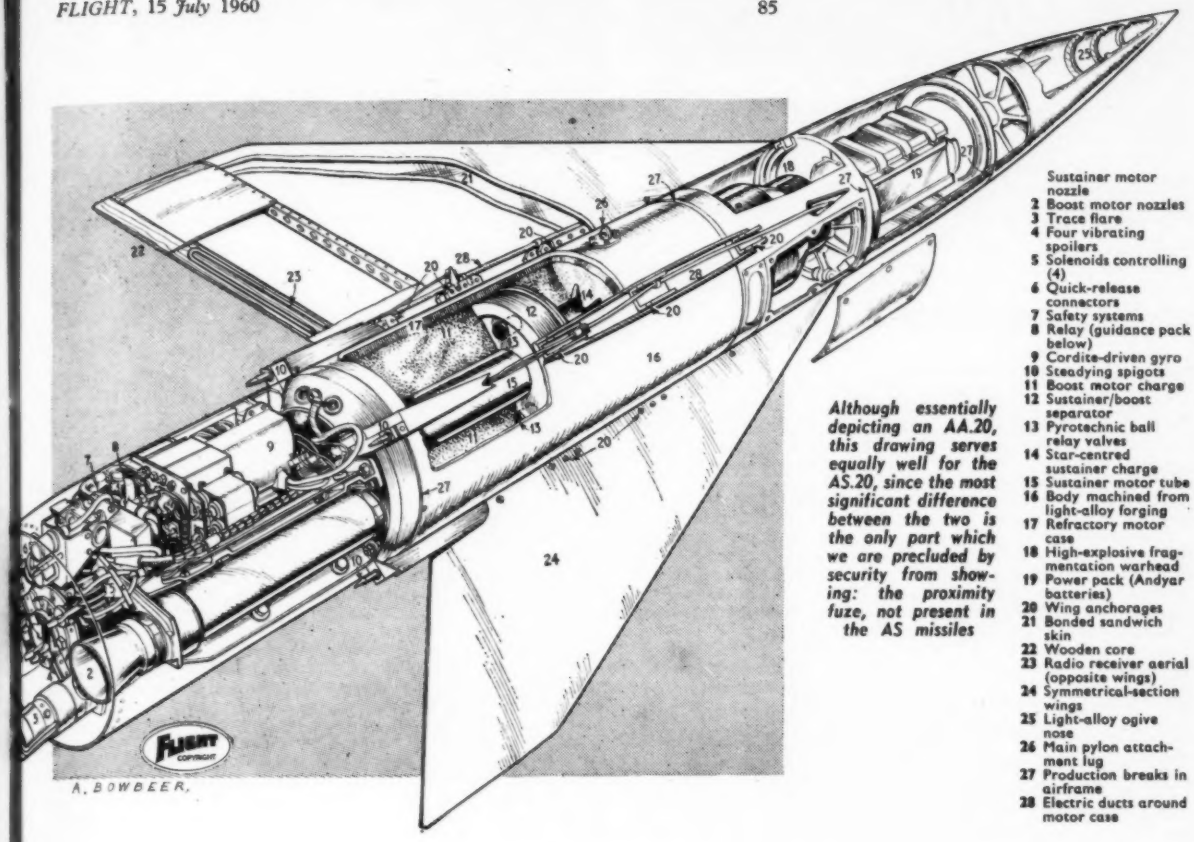
Like that of the earlier Nord missiles, the reference gyro is a small steel drum containing sticks of cordite which, when ignited, produce almost tangential jets. The outer gimbal is pivoted parallel with the roll axis of the missile, so that the gyro retains a fixed axis in space as the rolling missile flies. A quadruple collector ring and four-sector commutator integral with the gimbal system distribute the command signals to the two pairs of spoilers as the latter pass in turn through the plane demanded. Power for the command-link receiver is supplied by a 27V package of instantaneously self-activating Andyar batteries in the missile nose, HT current being fed from a high-voltage static inverter.

Functioning of the two pairs of spoilers is clarified by one of the diagrams. Each spoiler blade is machined from temperature-resistant steel and is mounted on an arm pivoted to the rear of the missile body. The other end of the arm is located between a pair of drum solenoids which are energized alternately, so that the deflecting blades vibrate in pairs (one into the sustainer gas stream, the other out) with a frequency of the order of 10c/s. Since the spoilers move perpendicular to the jet axis they dissipate little power. At each quarter revolution of the missile the reference gyro indexes the command signal to the next pair of spoilers, to offset their neutral position and thus cause a resultant deflection of the sustainer jet.

When the missile has reached its nearest point to the target the warhead is detonated by a proximity fuze. Fuze details are classified, but the system "looks" through a grey "window" around the forebody. The standard warhead has a weight of 50lb and is of the optimum-fragmentation variety. Should the warhead not be triggered by the proximity fuze it will be detonated by a self-destruct system at sustainer burnout.

Quantity production of the Nord 5103 was established at the main Nord factory at Chatillon-sous-Bagneux, and manufacture of motors and warheads was conducted in the isolation of the fort at Gâtines built during the Franco-Prussian war. Some thousands of 5103s have now been delivered to both the Armée de l'Air and Aéronavale, and a few are also being produced for other NATO air forces. The missile is standard equipment on the Dassault Mystère IVA, Super Mystère B2, Mirage III, Etendard IVM and Sud Aquilon. It can also be carried by many other types of aircraft, since it needs no airborne radar, apart from a radar-ranging gun-sight. A close similarity between the various members of the Nord missile family has been found of peculiar advantage in the training of personnel. The programme for fighter pilots of the Armée de l'Air is conducted partly on synthetic trainers and simulators very similar to those already in production for the anti-tank missiles. Moreover, since the problems of control are almost identical, practice with live rounds can be restricted to a couple of firings of SS.11 from a Fouga Magister.

It is now three years since the AA.20 system was cleared for genuine squadron use with the Armée de l'Air and Aéronavale. It entered service ahead of all other European air-to-air missiles with the sole exception of our own Fireflash, already mentioned,



1 Sustainer motor nozzle
2 Boost motor nozzles
3 Trace flare
4 Four vibrating spoilers
5 Solenoids controlling (4)
6 Quick-release connectors
7 Safety systems
8 Relay (guidance pack below)
9 Cordite-driven gyro
10 Steadying spigots
11 Boost motor charge
12 Sustainer/boost separator
13 Pyrotechnic ball relay valves
14 Star-centred sustainer charge
15 Sustainer motor tube
16 Body machined from light-alloy forging
17 Refractory motor case
18 High-explosive fragmentation warhead
19 Power pack (Andyar batteries)
20 Wing anchorages
21 Bonded sandwich skin
22 Wooden core
23 Radio receiver aerial (opposite wings)
24 Symmetrical-section wings
25 Light-alloy ogive nose
26 Main pylon attachment lug
27 Production breaks in airframe
28 Electric ducts around motor case

Although essentially depicting an AA.20, this drawing serves equally well for the AS.20, since the most significant difference between the two is the only part which we are precluded by security from showing: the proximity fuze, not present in the AS missiles

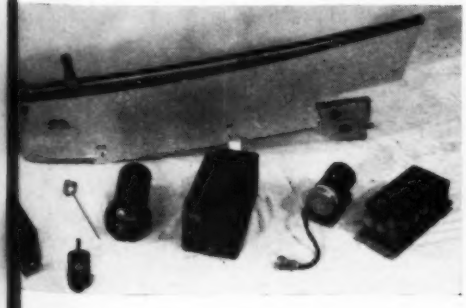
which became operational with No 1 GWDS at Valley at about the same time. However, the French programme was pressed through in a more wholehearted manner—this is no reflection on Fairey, who did more than was asked of them, but on the policy of restricting the British weapon to a token "indoctrination" role—and there is no doubt that even today AA.20 can in many situations be most valuable. It is in wide service, it is cheap, many hundreds of pilots are trained to use it and it is extremely reliable.

Nevertheless it can never escape from its basic shortcomings. Not only is the need to watch the target visually a grave handicap but the very act of flying both a fighter and a missile at the same time is one which makes fairly severe demands on a single pilot—indeed it would be all but impossible were the AA.20 missile not so "smooth" in its response to control. In an effort to overcome these limitations Nord evolved the 5104 missile, with the service designation of AA.25. Although very similar in appearance to the AA.20—apart from being slightly shorter—the improved missile is guided by a self-contained radar system.

Details remain classified, but it is obvious that the parent aircraft must carry a search and tracking lock-on radar which can then form a beam down which the missile can ride. Such an arrangement should have all-weather capability. Originally it is likely that the AA.25 system was tied in with the CSF Cyrano as part of the Mirage III weapon system, but the future of the programme appears uncertain. More recently, Northrop included the missile as part of the Rapiere weapon system, which is based on the Norair N-156F equipped with Hughes Taran radar fire control. This radar contains major circuits from the MG-13 now in service with the F-101B intercepter, and is said to be well matched to the Nord missile.

For the future, however, Nord appear to be concentrating heavily upon air-to-surface applications. It is several years since it was first appreciated that the visual command guidance of the AA.20 could with advantage be employed against ground targets, and early flight trials confirmed all that had been hoped. The resulting AS.20 (*air-sol*) is superficially identical to the air-to-air weapon, apart from the fact that the latter has a grey ring round the forebody denoting the presence of a proximity fuze. No such fuze is needed against surface targets, and a further advantage is that, since the trajectory is always downwards, and in dense air, launch weight can be higher without penalty in flight performance, and the extra weight and space have enabled the warhead to be increased in size. The standard charge is 73lb, and contact-fragmentation, ground-proximity fragmentation and penetration high-explosive heads may be employed at will.

Operation of the AS.20 is identical in principle to that of the AA.20, and to that of the American Bullpup which it so closely parallels. Bulk production was put in hand at the big missile plant at Bourges, near the centre of France, more than a year ago, and many thousands of AS.20s are now on order. It seems likely



At far left is the AA/AS.20 equipment carried in the aircraft; in front of the launcher are (from left) range computer, control stick, aerial, transmitter (two packages), co-ordinating transformer gyro and co-ordinating transformer. The other picture shows the container (617lb empty), with lid compartments for powerpack and fuze and support frame for the missile body and warhead

An AS.20 on a Super Mystère B.2; body, forebody (warhead) and each of the four wings bear the missile serial number (832 in this case)

An AA.20 on an Aquilon (Sea Venom derivative) of the Aéronavale, showing the proximity-fuze ring peculiar to the air-to-air weapons

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that nearly all NATO countries will use it, and it is already deployed with Fiat G.91s of the Italian Air Force and Luftwaffe. Flight trials with the AA.20 were chiefly based at Colomb-Bechar (Sahara) with Mystère IVs and SMB.2s; but the G.91 and AS.20 combination has been evaluated at Cazaux, near Bordeaux. Nord have also developed the AS.25, a radar-guided version paralleling the AA.25, but no information on its progress is available. Both the AS.20 and AS.25 are also named as part of the Northrop Rapiere weapon system.

Nord's first essay into the surface-to-air field originated around 1956, when almost every missile firm in France competed for the chance of a production contract for a weapon system in this category. Nord had plenty of business already, and entered merely because they felt—probably correctly—that they could develop a suitable weapon more quickly and cheaply than their competitors. Their missile, the ACAM 5301, bears a close family resemblance to the air-to-air weapons. In principle it is similar to the AA.25, the only superficial change being the fact that the sustainer charge, like the boost motor, has twin nozzles, both equipped with jet-deflectors for steering purposes. The 5301 was intended for use against aircraft flying at heights between 40,000ft and below 1,000ft, at up to 870 m.p.h. The sustainer burns for 24sec, and during this time guidance is effected Nike-fashion by signals transmitted from a ground radio aerial working in conjunction with a computer and a target-tracking radar. In the event, the 5301 did not achieve production; but then neither did any other French surface-to-air missile. (Photograph, *Flight*, October 23, 1959).

Nord's new air-to-surface weapon is the AS.30. It is subject to strict security classification, and the only official reference that has been made to it was the inclusion of a scale model among a display of stores which can be carried by the Mirage IIIE. The exhibit, which was displayed at the recent Hanover Air Show, suggested that the AS.30, while retaining the basic configuration of the other members of the family, has—in one form at least—wings of very low aspect ratio and square axial tips. The data given in the table are those published by Northrop and the Italian magazine *Alata;* they have not been confirmed by the manufacturer. The AS.30 is certainly large enough to have a nuclear warhead, and it seems to be interesting many countries.

To conclude the story, brief reference may be made to Nord's new surface-to-surface (and, eventually, air-to-surface) weapon designated SS.12. Although the wings are unswept, flight performance is even higher than that of the SS.11. Its size is such that if it were American it could carry a number of types of nuclear warhead, but even in the absence of such devices its blast effect is high enough for it to be highly effective against all forms of battlefield target, including the heaviest pillboxes and armoured vehicles. Too heavy to be carried by infantry, it is fired from a zero-length launcher mounted on any vehicle of Jeep size and upwards. Wire guidance is retained, and it has been found possible to employ the same type of control unit as that used in the earlier weapons. Trials with SS.12s began in the winter 1958-9, and a year ago the French Army had already obtained some experience with the weapon and found it to show extreme promise. Much may be heard of it in the future.

BLUE STEEL Mk 1

Although he was careful to say nothing specific about its development schedule, the Minister of Defence—in a written reply in the Commons on July 6—said that progress with the Avro Blue Steel Mk 1 was "going well" and that launching trials were currently taking place. Since full-scale test vehicles and a variety of smaller powered prototypes have long since been flown at Aberporth—*Flight*, March 11, 1960—Mr Watkinson doubtless was referring to tests with genuine Mk 1 missiles, complete with propulsion (in the first version, a D.H. Double Spectre rocket engine), guidance (Elliott inertial) and control systems, flown from Valiants and/or Vulcans at WRE Woomera.

The Mk I weapon, he said, will give "several years" of useful service before Sky Bolt is available. Blue Steel Mk 2, which was obviously to have been a completely new device and not just a modification, would not have been in service with Bomber Command until after the mid-1960s, "when it might well have been outmoded." Accordingly, it was cancelled "at a very early stage" last year. Instead, said the Minister, "the possibility of improving the performance of the present Mk 1 is being investigated." One London daily has suggested that the improved Mk 1 will be designated Mk 1*, and that it is really only the resuscitated Mk 2 smuggled in under a new name; but this seems an unwarranted, and most unlikely, allegation. It would only be logical commonsense to explore all avenues by which the operational effectiveness of Blue Steel Mk 1 can be improved without introducing any fundamental redesign.

SOVIET PACIFIC ROCKET

Late on July 5, Moscow Radio reported that tests of new types of "powerful multi-stage carrier rockets for space exploration" would be carried out in the Soviet Union between July 5 and 31. The statement continued:

"In accordance with this plan, one of these rockets was launched on July 5. The rocket was launched strictly on schedule. The flight of this rocket proceeded in exact accordance with the preset flight programme.

"The dummy of the last stage of the rocket, adapted for passage through dense layers of the atmosphere, reached the surface of the water in close proximity to the target, 13,000km (approximately 8,000 miles) away from the launching site. Special vessels took measurements envisaged by the programme and obtained valuable results.

"To accumulate further experimental data, the testing of powerful ballistic rockets will be continued. The rockets will fall within the boundaries of the zone indicated in the Tass announcement dated June 29, 1960."

Then on July 7 Tass announced that a second multi-stage ballistic outer-space rocket had that day been fired "precisely on time. It followed the preset course exactly and, according to special vessels in the area, the dummy nosecone hit the water right at target point. With the successful launchings . . . on Tusday and today . . . the need for continuing tests . . . no longer exists. All the necessary data has been obtained for the completion of the carrier rocket intended for the further conquest of cosmic space."

NO MORE PICTURES

The US meteorological satellite Tiros 1, after transmitting 22,952 pictures since its launch on April 1 this year, has "reached the end of its operating lifetime." The experiment demonstrated the feasibility of observing the mechanics of the atmosphere from a satellite and, although Tiros data will be the subject of detailed analysis for many months to come, the data processed to date has already made important contributions to meteorological research.

Among the most striking cloud patterns transmitted by Tiros are the large-scale cyclonic storms or vortices whose spiral bands sometimes reach over 1,000 miles in diameter. The frequency and extent of highly organized cloud systems associated with these vortices was not previously fully realized. Other pictures have indicated the presence of jet streams, regions of moist and dry air, thunderstorms, fronts and other meteorological occurrences. The experimental use of Tiros pictures in meteorological analysis is said to have resulted in increased accuracy, particularly in regions (such as over the oceans) where data is sparse.

The Tiros satellite weighs 270lb and was operating in an orbit at an average altitude of 450 miles. Of the 22,952 picture frames transmitted by it, 4,698 from the narrow-angle camera and 12,751 from the wide-angle camera were received at Fort Monmouth, New Jersey; while Kaena Point, Hawaii, received 1,117 narrow-angle and 4,386 wide-angle pictures. Of the total number received, it is estimated that over 60 per cent represent good-quality cloud-cover photographs useful to meteorological research.

A NASA statement giving this information continued:

"The decision to discontinue attempts at interrogating Tiros 1 was made after orbit 1,302 over Fort Monmouth about midnight Wednesday, June 29. The wide-angle camera system and all telemetry had ceased to function (the 108Mc/s tracking beacon continues to operate).

"There appears to be some limited operational capability remaining in the narrow-angle camera system. However, it would be extremely difficult, perhaps frequently impossible, for meteorologists to identify and orient the narrow-angle camera pictures. The satellite's attitude sensors are not working and there are no longer wide-angle photos, which frequently pick up identifiable geographic landmarks, to assist scientists in orienting narrow-angle cloud-cover photos.

"Scientists believe an inoperative relay in the wide-angle camera system is the probable cause of Tiros' difficulty. The malfunction made it impossible for the camera to turn off. This apparently drained the batteries and eventually caused the wide-angle camera transmitter to burn out. This damage seems to have affected the entire satellite system.

"Tiros interrogation was temporarily suspended on June 17, after 78 days of operation and after over 200 hours of individual camera operating time. On June 28 and 29 attempts to resume interrogation indicated that the satellite's effective operating lifetime was at an end. It is planned to launch the next experimental meteorological satellite, Tiros 2, later this year."

FOUR-STAGE SCOUT FIRED

The first firing of a complete four-stage Scout solid-fuel rocket was made from the NASA station at Wallops Island, Virginia, on July 1. The rocket was scheduled to achieve a maximum height of 2,300 miles and a range of 4,700 miles, but because of a malfunction the achieved performance was 860 miles altitude and 1,500 miles range. The first three stages fired successfully, but ignition of the fourth was prevented by a command signal made when the vehicle appeared to veer off-course. Scout is the vehicle chosen for the Anglo-American scientific satellites, the first of which is planned to be launched next year.

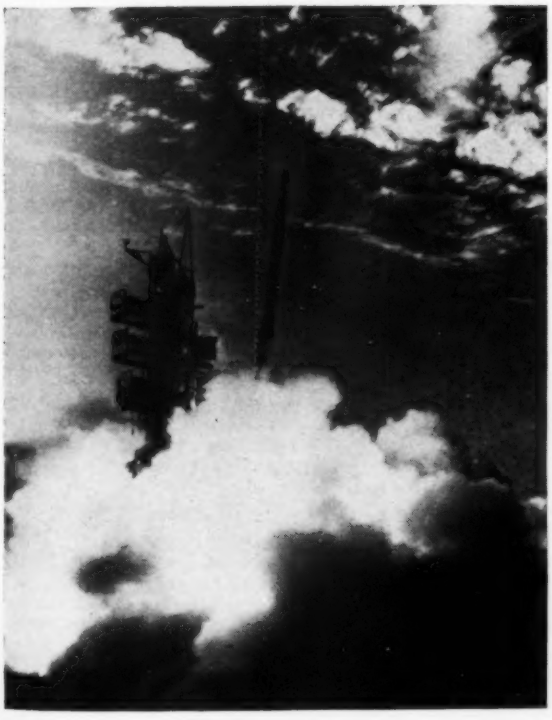
ANIMALS IN SPACE

In an ambitious experiment last month a single-stage Soviet rocket was used to fire a scientific payload of 2,100kg (4,600lb), including two dogs and a rabbit, to a height of 208km (130 miles). Announcing this on July 4, Tass reported that the launching was for research into the upper layers of the atmosphere and cosmic space. For one of the dogs, named Otvazhnaya (Courageous), this was its fifth flight into space.

The Tass statement said: "The research programme has been completed. Valuable information has been obtained on ionizing clouds, which form at high altitudes, the ion composition of the atmosphere and its electrical properties, radiation of the Earth and Sun, and also new material in the muscular tone of animals in conditions of weightlessness. The measurements and observations are being analysed."

The animals and instruments were carried in a jettisonable container which descended to Earth by parachute. A later statement by a Soviet geophysicist amplified the details of the experiments carried out. In addition to the determination of the electron concentration in the atmosphere, the chemical composition had also been studied. Speaking of the photographing from high altitudes of clouds in the atmosphere, the scientist said that a series of pictures had been obtained which would give a clear idea of weather-forming processes over a vast area. In the rocket's research programme much attention was given also to the study of the density of the upper layers of the atmosphere, the solar spectrum in the ultra-violet range and the infra-red radiations of the Earth.

Firing of the first four-stage solid-fuel Scout rocket from Wallops Island on July 1 is reported on this page. First three stages fired successfully, but the rocket was destroyed prior to fourth-stage firing when it veered off-course



HUGHES TO BUILD ION ENGINE

Contract negotiations began last month between the National Aeronautics and Space Administration and Hughes Aircraft Co. for the design, development and laboratory-test of an experimental ion engine. The programme is expected to take one year and to cost over $500,000. The experimental unit will develop approximately 0.01lb of thrust, and may be followed by higher-power units at a later date.

It is hoped ultimately to use engines of this type to propel spacecraft on interplanetary missions. These engines would require a nuclear auxiliary power source such as SNAP-8, now under development. Ion engines will not be used as primary launch engines because of their low thrust output. They would be built into spacecraft and turned on after the spacecraft achieves a predetermined trajectory.

PERSUASION FOR POLITICIANS

Representatives of the British Interplanetary Society put forward a strong recommendation to Members of Parliament on July 6 that this country should embark on a much larger-scale space programme than is planned at present. The society's spokesmen on this occasion were Dr L. R. Shepherd (president), A. V. Cleaver and P. G. Masefield, and their main immediate concern was that the development of Blue Streak should continue.

To complete Blue Streak as a launching vehicle, it was suggested, would cost £45m, and the cost of adding Black Knight as a second stage might be estimated at £20m. To do this, in addition to the programme currently planned, was the first main point. Six other major steps were put forward: (1) to develop more powerful second and third stages for a modified Blue Streak; (2) to carry out a feasibility study of communications satellites; (3) to design equipment and techniques for communication, telemetry and navigation in space; (4) to pursue a developing programme of research on hypersonic winged vehicles and their use for controlled re-entry; (5) to carry out a "modest" programme on space medicine; and (6) to carry out a programme of research and development on new propulsion systems.

A "significant" programme along these lines, the society believe, could be achieved for a further annual cost (in addition to that quoted for the Blue Streak/Black Knight development) rising within five years to £20m per year and continuing at this level.

In a written reply on July 5 the Minister of Defence, Harold Watkinson, stated that joint Anglo-German development of the English Electric Blue Water corps-support missile was still under consideration. It would, he said, "be equipped with a nuclear warhead under NATO arrangements. Any nuclear warheads . . . for Federal German forces would be held in the NATO atomic stockpile under Saceur."

In a verbal Commons reply on July 4 the Minister of Aviation, Duncan Sandys, said that all the work of modifying V-bombers—principally Vulcan B.2s—to carry GAM-87 Sky Bolt will be done in Britain. But, he warned, "it does not mean necessarily the electronic equipment or other kinds associated with the weapon, which will be purchased in America." Later he qualified this with "I do not say that *all* the electronic equipment will be made in America."

At a press conference in Bonn on July 4 the US Secretary for the Army, Wilbur Brucker, said he knew that Franz-Josef Strauss, the West German defence minister, was "interested" in having the Bundeswehr equipped with a land-based version of the Polaris. He is reported to have continued: "We [presumably the United States] have not only no objection but positive support for this type of weapon for West Germany." Fearful of the storm which such a statement could not fail—and did not fail—to create in many other countries, Herr Strauss's ministry quickly denied that they were doing any more than keeping themselves informed of the situation, and that if NATO approached West Germany with a concrete proposal it would be "seriously examined." The Western European Union treaty of 1954 does not forbid German possession of guided weapons—only their manufacture.

Straight and Level

PROGRAMMES sold at RAFA displays help to raise money for a good cause, so perhaps one shouldn't be too critical of their contents. But this effort in one particular recent shillingsworth (I quote verbatim) seemed to strike not quite the right note:—

"THE ADVENT OF Flight Re-fuelling recalls memories of Bombers and Fighters, disintegrating around one, airborne holocausts, sweeping across the night sky. Plunging vertically into heavy cumulous, fusing the clouds orange and crimson, as they plummet earthwards. The crews aboard, octained cremations, the night sky, a canvas of searing destruction . . . "Home James—lets get to hell out of here" the Skipper calls, but, rich mixture, full throttle climb, in those days, meant a consumption of 240 gals. per min. . . ."

Spelling, 0; punctuation, 0; theme, 0. General remarks: See me in my study after prep.

● Princeton University, conferring upon John Cobb Cooper an honorary doctorate of laws last month, delivered the following citation:—

"Attorney to the air, brilliant barrister to the wild blue yonder, of him it may be said what John Donne remarked of Bishop Valentine: 'All the air is thy diocese.' If he cannot legislate the lightning nor adjudicate the winds of Aeolus, he yet knows how to protect the rule of law and right reason against the lowering face of the firmament."

All of which should make Dr Cooper, who is IATA's legal adviser, feel a very honoured honorary Doctor of Laws.

● The story goes that Mr R. M. Ansett and Mr John Ryland were not able to agree which of their two airlines, Ansett-ANA or TAA, should be the first to operate a new competitive service from Sydney to New Guinea after Qantas retired from the route.

What happened in the end was that a TAA DC-6B opened the service on July 9, an Ansett-ANA DC-6B following on July 11.

How was this agreement reached? Mr Ansett decided that they should toss for it. He lost.

● If you happen to see a BEA Heron with the name *Sister Jane Kennedy* on it, you will be seeing a memorial to the nurse who lost her life in a BEA Heron ambulance which crashed three years ago while answering an emergency call. The crew of two died also.

In a simple ceremony the other day a new BEA Heron was so named by the nurse's sister, Mrs Catherine MacIntyre.

Sister Jane and her crew could hardly have wished for a more fitting memorial

● "I believe in being frank with the public."—*Mr Duncan Sandys, Minister of Aviation, talking to the Press about jet noise.*

At the possible risk of refuelling myself with my own exhaust, and bearing in mind the context of the remark (see page 101), I would just like to quote what *The Guardian* said about it: "However wise, careful and just his policy may be, it is not frank."

But I am bound to express pleasure that Mr Sandys says he *believes* in being frank with the public. Let him now *be* frank. I have a feeling that public hostility to jet noise is being exacerbated by the Minister's defensive public relations policy. If ever there was a case for really frank Ministry public relations, this is it.

● From a Canadair paper, "Modern Cargo Aircraft Design," May 1960: "We have often been questioned about the origin of the swing-tail. We knew the idea had been generally discussed in the industry since the end of World War 2, but after a little historical research we were surprised to discover the concept goes back at least 38 years. [Slide No 9: 'Gloster Swing-Tail, excerpt from 1925 *Flight*'.]

"Three years after the original proposal, as you can see, *Flight* was becoming somewhat impatient at the delay in applying what was obviously an excellent idea to a production aircraft. As it turned out, they only had another 35 years to wait."

On my right, an air vice-marshal in un-Brass Hat-like attitude: AVM Peter Wykeham, who commands the Group whose aircraft drop the Army parachutists, is being hauled in after trying out the dropping business for himself from a Twin Pioneer off the Dorset coast. But why did he fall into the sea? Surely all dropping zones are on land? Anyway, I applaud the AOC's initiative and award him this week's Bacon flitch

● A Vickers Vimy which first flew to Australia in December 1919 has been reconstructed with the aid of technical advice from the manufacturers.

"It was easy," says a Vickers spokesman. "It didn't have to fly again."

● "US living standards are so high that when workers go on strike they have to picket the factory in their private aircraft to prevent blacklegs getting to work in *their* private aircraft."

Ha, ha, that's quite a funny story to tell at a Soviet Embassy cocktail party. It happens to be a story that's coming true. Downtrodden missile workers at Convair Astronautics recently on strike for more pay had to picket the plant with aircraft towing banners in order to dissuade would-be scabs from trying to get in by helicopter.

● Outspoken Dr J. Nit, controversial British air expert, last week commented on the recently published *Flight* description of the Ilyushin Il-18.

"I would say it appears to be a pretty workmanlike job—yes, a pretty workmanlike job," he conceded, polishing the cursor of his slide-rule. "Mind you, I think the pattern on the cabin carpet is bit behind the state of the art. The Russians have obviously a long way to go before they catch up with the state of the art, you know. And I must say that I find all that funny lettering on the outside of the aircraft, and in the cockpit, too, difficult to understand — which might not be a good safety feature.

"Of course, we know nothing about

Russian safety standards. For instance, it appears that the Il-18's cockpit can be sealed off from the passenger cabin, as in the Tu-104 and the Tu-114, to give the crew an extra margin in the event of a pressurization failure. This is an airworthiness standard that British pilots suggested long ago—but *what* a weight penalty, what a weight penalty! It's all a question of the state of the art, you see, and of course we know nothing about Russian safety standards . . ."

● "Some of the lies in that brochure just simply are not true."

Security

We know.
The Ministry know.
They know that we know.
We know that they know that Foreign Powers know—but *Flight* can't write anything about it.

ROGER BACON

FLIGHT SYSTEM SURVEY

FAA May Standardize VGPI

THE Research and Development Bureau of the FAA has recommended the adoption as a US national standard of the British Visual Glide-Path Indicator (VGPI) developed by RAE and now produced by Thorn Electrical Industries Ltd. Five different systems, a US Navy mirror sight, a USAF light pattern, a Westinghouse three-colour projector and the Australian Cumming Lane light pattern were intensively studied at NAFEC, as reported in *Flight* for April 15, and the proposal to adopt the British system is therefore most encouraging. The final decision is to be made early in August.

The VGPI is a two-colour system in which two pairs of wing bars, each formed by three indicators, bracket the touch-down point and define a glide-path of finite depth. The individual indicators show red below or white above a given angle, with a pink transition zone. They are easy to interpret, not impaired by rain on the aircraft windscreen and have constant sensitivity throughout the approach. VGPIs are already installed at London and Belfast airports and are scheduled for other airfields in Britain. There is also considerable interest from abroad.

Orders for SARAH

AN order worth approximately £14,000 has been placed by Flight Refuelling Ltd with Ultra Electronics Ltd for a quantity of SARAH rescue beacons to be used in the recovery of cameras carried in drone aircraft. Bristol Aerojet have also placed an order for SARAH for use in the recovery of missile test vehicles and a small number of SARAHs is being supplied to RAE.

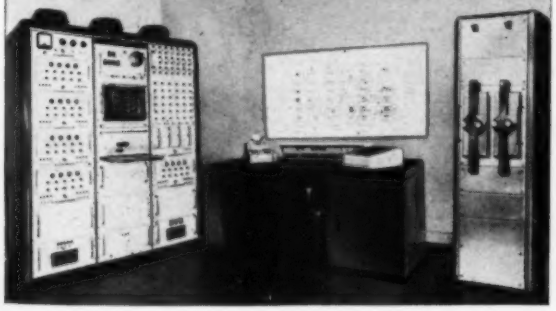
Decca Marks Time

IT is clear from a recent exchange of questions and answers in the House of Commons that, although Britain and the Commonwealth countries continue to support Decca Navigator, the British Government does not intend at the moment to make any determined effort to change the ICAO decision. Australia is to carry out Decca trials and important technical developments are continuing in Britain, but the Government is standing loyally by its membership of ICAO and resultant obligation to respect the organization's decisions.

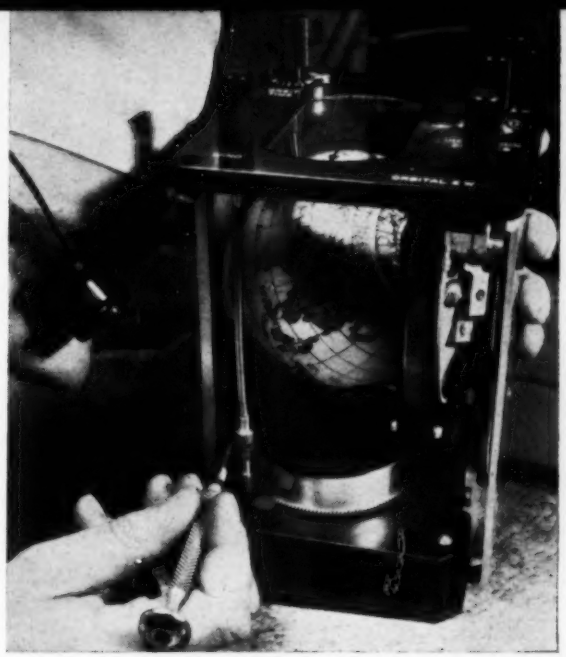
Redifon Radic Computer

THE new Redifon Radic computing system is claimed to be the first in the world to be specifically developed to combine the stability, convenient input/output equipment and extensive storage facilities of the digital machine with the speed of operation, ease of programming and low cost of the analogue. According to the particular choice of components, a Radic system might cost between £10,000 and £150,000. One of its main applications will be in designing automatic process controls for complex industrial processes, a task for which conventional computing techniques have generally proved uneconomic. For example, Radic is considered to be the first practical tool for the analysis and design of heat exchangers and chemical reactors. In the aircraft industry it might be applied to precision, real-time study of long-term phugoids and other oscillations. Actual parts of aircraft or autopilots could be incorporated in the computer. Non-linear flight equations subjected to noisy and statistically random functions might also be studied.

A typical medium-sized installation of the new Redifon Analogue-Digital Computing System (RADIC) described on this page



Input and output devices of various types can be used to feed-in and extract digital data from the system and a special, independent magnetic-tape digital storage system can be detached and transported to a site to analyse a process. The information is stored in steps, the tape being run on sprockets and moved forward in stages timed according to read-out requirements. Time delays may be accurately simulated because the tape-reading head may be displaced from the recording head by an accurately timed distance.



An earth path indicator designed by Minneapolis Honeywell for the Mercury capsule to show the pilot his position over the earth. The globe is painted with topographical features and longitude lines, South-East Asia being visible through the side of the instrument in this view

Doppler Navigation Computers

AN order has been placed by Irish International Airlines for Canadian Marconi navigation computers to operate with the CMC Doppler sensors which have already been ordered and are being delivered to Boeing for installation in the Irish airline's fleet of jet transports. This is the fourth international airline to order CMC computers as well as Doppler sensors during one month.

Piper Buys Electronics

AN electronics company called Aero Signal Laboratories has been bought by Piper Aircraft Corp and moved from its former premises at Phoenix, Arizona, to the Piper Engineering and Development Centre at Vero Beach, Florida. The principal product of the electronics company is an airborne DF receiver which Piper is to continue manufacturing and offer under the name AutoNav as optional equipment on all its single-engined aircraft. Piper state that the light weight, low cost and great usefulness of AutoNav, which can home on LF beacons and commercial broadcast stations, will make it a popular accessory.

Mechtronics for Students

THE two companies, Clarke-Smith Manufacturing Co Ltd and Griffin & George Ltd have combined to produce the Griffin-Clarke-Smith Mechtronics type 97-100 electronics constructional outfit which allows pupils to assemble for themselves experiments and demonstrations illustrating many of the fundamental principles of electronics. The set covers the revised syllabus for GCE at Ordinary and Advanced levels. All connections are screwed or clipped together on a pegboard layout, and all current is supplied from 4.5V and 120V batteries. The set includes valves, transistors and photo-electric devices, transformer, relay loudspeaker, circuit board, neon tube, crystal diode and potentiometers, bulbs, holders, switch parts, special connectors, wires, valve holders, resistors, capacitors and other components.

Also available in the Griffin-Clarke-Smith range are a compact and simple oscilloscope (£14 14s), a valve volt meter (£16 16s) and an AF and RF signal source (£15 15s). The type L97-100 costs £9 17s 6d. The address of Griffin & George is Ealing Road, Alperton, Middlesex.

The cockpit layout appears to conform exactly with Aeroflot's specifications, even to the Russian placarding. Left, Capt Kapitany Istvan; right, Capt Szentgyorgyi Bezsö

Malev have two Il-18s, the first having been [illegible]. A

HUNGARIAN VISITOR

"Flight" photographs

THE first visit to London—[illegible]wick—of a Malev Ilyushin [illegible]ce on July 4. It was a special [illegible]g a Hungarian choir. An Anglo-[illegible]ir agreement is now being negoti[illegible]s believed that Malev and BEA [illegible]o

[illegible] 89:

The flight crew on the special London flight comprised the normal complement of five plus two supernumeraries—three pilots, navigator, radio officer and two engineers. They are seen here with the stewardesses—of whom another view appears on the opposite page—and Mr D.G. Thompson, Shell Mex and BP's superintendent at Gatwick

…ving been …l. A third is due in September. Cheat lines are Oxford and Cambridge blues: stripes on the fin are red and green

…ndon—a…t-
…ushin l…ce
…special …g
… Anglo-…ir
… negoti…is
…d BEA …to

start a regular London - Budapest service on April 1 next. Malev's fuel is supplied in western Europe by Air BP, who recently concluded contracts also with the Rumanian and Bulgarian airlines Tarom and Tabso. The Il-18 was fully described in "Flight" for July 1.

…89: 20 in the forward cabin, 55 in the main cabin, and 14 aft

HELICOPTERS IN AUSTRALIA

A Big Development is Forecast . . .

WITH several new companies registered for the purpose of developing regular passenger services by helicopter, and at least one of the major airline operators committed to a Sikorsky S-61 interest, the story of commercial helicopter operation in Australia is entering a new phase. At the same time, the RAAF is beginning to evaluate the American and British helicopters of the Bristol 192 class for its requirement for Army-Air Force transport.

When it is considered that up to now not one passenger has been carried on a regular scheduled helicopter service in Australia, and that the largest "chopper" in the country is the Sycamore or S-51, an idea can be formed of the revolution that will shortly occur. The big event has been the recent admission by Ansett-ANA that they have paid down £A5,000 as a deposit to Sikorsky in order to be on the production line. Ansett-ANA did not announce this transaction at the time and when it did appear in the press Mr Ansett explained that this did not constitute a definite intention to buy the S-61. However, if the policy was decided concerning big helicopters, Ansett-ANA would be in the right place for delivery. Mr Ansett has compared the S-61 deal with that for the Super-Broussard: he has six places on that production line, without a payment. Nevertheless, he is now committed in the public mind to large helicopters, particularly as there has been very big press publicity for his helicopter plans in the Sydney-Newcastle area. The Ansett-ANA house magazine has stated that the airline has plans and is moving among the town and city councils of coastal New South Wales to secure local goodwill.

At the moment, the situation has its humour. All the mayors and councils of the townships and cities within a hundred miles of Sydney are being approached by several companies, most of them brand-new, to secure rights to use heliports which have not yet been built (and in general not even thought of before the contacts were made). Everybody wants to get in first. Some rather peculiar statements are being made in the Press which allege the securing of exclusive rights to operate helicopter services into certain townships and even claim to have been given rights by the NSW government. In this country, intra-State operation legally must be sanctioned by the States but in fact the States have given these rights to the Commonwealth—there would be chaos otherwise. No State authority would think of granting rights before the Department of Civil Aviation has given its approval. It has not.

The DCA has given approval for one service, which will be the first regular passenger service to be operated with helicopters in Australia. This is between Essendon Airport and a heliport now being constructed on a pontoon in the Yarra, in downtown Melbourne. This 7-miles service will be operated jointly by Ansett-ANA (whose idea it is) and TAA. Built at a cost of about £20,000, this will probably remain Melbourne's heliport until twin-engined helicopters arrive. The Department is adamant that single-engine helicopters must not be operated over built-up areas, but in this case the route will follow the river, parks and similar areas to give complete safety in case of engine failure in Ansett-ANA's Bell 47Gs or TAA's Hiller 12Es, which will operate the service, beginning November. Ansett-ANA have incorporated into the design of their new office block in Melbourne another heliport, but this cannot be used until twin-engine types are here. If single-engined helicopters could be used over built-up areas, a similar airport-to-city service would be started this year in Sydney, from Kingsford Smith Airport to the roof of David Jones's, a big downtown department store in Sydney. The Department of Civil Aviation has yet to pass judgment on this plan; but if its approval is given both airlines would open the service in a few weeks. Ansett-ANA have been planning this service for years.

What will happen about other routes is anybody's guess. Ansett-ANA have been studying for some years plans for services from Sydney to Parramatta, Mona Vale, Manly, Newcastle, Wollongong, Port Kembla, and other towns within a hundred miles of Sydney. There is no question that a big potential exists in that industrial and tourist complex. Like other cities, Sydney is being strangled, and to get out by car is one of the tribulations of life. The potential is so obvious that some new companies have been registered to operate these routes.

Grant's Helicopters Transport Ltd is a Melbourne company, registered recently with a nominal capital of £A10,000,000, to operate services not only in the Sydney complex but also from Melbourne to such Victorian cities as Geelong, Ballarat and Bendigo. Two new firms in Sydney are Copter Air Transport and The Helicopter Corporation of Australia, both with big nominal capital and both planning big networks in the Sydney-country towns area.

In Australia, a would-be operator must present his plans to DCA, whose officers consider the organization, the intended equipment, the maintenance facilities and all other aspects of the proposed airline before they will give him a licence to operate. This all takes time and a good deal of money. There is also the

. . . by Stanley Brogden

question of local modifications to the aircraft which the operator wants to buy. Australia does not blindly accept the aircraft on sale elsewhere in the world, though obviously if an aircraft has a C of A in Britain or the US it is pretty likely to be approved. Generally speaking, however, there are some modifications required before passengers can be carried here. At the moment, it appears that Ansett-ANA have taken the main step, but there are claims flying about in the Press by operators who say they have placed orders for S-61s, S-58s and even Rotodynes, with delivery next year! While it is difficult to cut through the claims, it would appear that some S-58s may be on order and that services may be started with these. But it will be some months before any real statement of fact on the situation can be made.

TAA have a much more conservative approach. They do not see the helicopter making money yet on passenger services. They are ready to lose money on the airport run to secure experience and give passengers a break. They cannot see that the big helicopters would show a profit, for the business is not there to fill them. They would like a twin-engined eight-seater, which is not available anywhere yet. TAA's hand would be forced if Ansett-ANA do go ahead with the S-61 project, as it is my personal impression that they will. TAA realize the Barrier Reef area is a very great helicopter possibility. Both operators carry big loads into Mackay and other Queensland ports for Hayman Island and other island resorts on the Reef. Getting from the coast to the islands takes hours, or even means an overnight stop on the mainland. A helicopter could save all this. Even if it lost money, the airline which first used 'copters on the Reef would take passengers away from the airline which did not. If Ansett-ANA put helicopters on the Reef run, then TAA must follow or lose business. Ansett-ANA have been studying plans for the Mackay-Hayman Island service. They need more than twenty seats for each service, as their mainland aircraft generally drop more than twenty passengers at Mackay in the season. The S-61 would be ideal for this service—as would the Vertol 107 or Bristol 192, for that matter. Ansett-ANA are very S-61-minded, but their representatives are looking over other types in America.

The Ansett-ANA plan is, I understand, for two helicopters of the 24-seat type to be operated in the Sydney complex and the Barrier Reef region. In each case the aircraft concerned would need to fly 2,000hr each per year. This is a long-range view, of course, but 2,000hr is accepted as the essential to secure economic operation, given more than a 60 per cent load-factor. This would allow a Sydney-Newcastle fare of 50s, with a similar fare on the Mackay-Hayman Island route. One aircraft might be briefly operated in these areas, but it is DCA custom to ask that two aircraft of the same type be available when a new type is introduced. I understand that Ansett-ANA have been considering second-hand Vertol 44s to begin the Barrier Reef service, for these could be bought in the USA for about £A110,000 each. Two would be needed to give the required seating capacity; they would give experience and set the pattern for operation pending future orders.

In the commercial field today, the helicopter is not being very widely used in Australia. Ansett-ANA have a Helicopter Division, run by Capt Max Holyman, son of the late Sir Ivan. They have a Sycamore and three Bell 47Gs, while TAA have two Hiller 12Es and a third on order. TAA have no Helicopter Division as such, but have a senior helicopter pilot, Capt Ivanoff, and pilots who combine helicopter flying with line operation. Ansett-ANA keep all their 'copter pilots on full-time work in the division. This typifies the attitude of mind of the two operators towards helicopters. Max Holyman has been running ANA's and Ansett-ANA's helicopters since they began operating them in 1956. A Sycamore was introduced in early 1956 and put to work in Tasmania, followed by a Djinn in 1957, and another Sycamore

in 1958. Up to now, about 5,000hr have been flown by ANA and Ansett-ANA helicopters, mostly on charter work and crop-spraying. One big contract is with the State Electricity Commission of Victoria, which takes 25hr each month on a Bell, patrolling powerlines.

TAA's most experienced helicopter pilot is Capt Ray Hudson, who ran their helicopters until a few weeks ago, when he returned to line flying. Though ANA ordered the first helicopter to operate commercially here, TAA's Hiller 12C was the first to fly in Australia (April 30, 1956). TAA got contracts for oil-searches in the North, which so impressed its main client, Consolidated Zinc, that the company bought a Hiller itself. Two more 12Cs were bought in 1957 and 1958; one from Consolidated Zinc crashed on Macquarie Island in the Antarctic Ocean. Last December and January, two TAA 12Cs went to the Antarctic Continent, but one was wiped off. While two 12Cs were in Antarctica, the TAA management did a deal which traded-in 12Cs against two new Hiller 12Es, both of which are now in operation. A third is coming. One of the mysteries of Australia is why the two airlines have not bought Alouettes, for most of the experienced helicopter pilots to whom I have spoken seem to want them. The Alouette was demonstrated here several years ago without a sale.

The third organization which has been operating helicopters here is Helicopter Utilities, of Sydney, which has been doing well on charter work for three years with Bell 47s. L. C. Williams, who runs this firm, was with Fairey. The Bells are very busy on Army surveying contracts in NW and North Australia.

So much for the commercial aspect. The military side is almost as vague with promises. The first helicopter to be operated in Australia was an RAAF S-51. The RAAF bought three, but two have been wiped off and the third is kept flyable (but not flying much) at Richmond. The RAAF actually did most of the pioneering here, bringing helicopters to the public attention before 1956 and even performing the first crop-dusting from helicopters. But helicopters never had any priority in RAAF commitments. The RAN has bought eleven Sycamores over the years and still has six operating with the Fleet. The Army has ordered eleven Bell 47Gs, to be operated by Army pilots. It is policy for the Australian Army to have the same equipment as the US Army overseas, which made the Bell a certainty.

The RAAF and the Army now have a requirement for a heavy helicopter, mostly for Army use, but to be operated by the RAAF (there is a weight limitation on the Army). The S-61 and Vertol 107 are being evaluated. The Bristol 192 has one big strike against it—no big rear loading door. What a fascinating fact it is: no British helicopter has a rear-loading door. So we come back to the C-130 problem again: the Australians will just have to buy American.

This situation is a little complicated by the Australian's love affair with the Caribou. The khaki types would like Caribous *and* 107s or S-61s. Finance being what it is in Australia they will probably have to settle for one, and that one would almost certainly be the helicopter, which could do both jobs and more besides. The advantage would be that the 'copter could also interest the RAN, which needs something for minesweeping.

The same helicopter for RAAF, Army and RAN would make sense. It would also make a nice fat order, and it would have some effect on the civil side. The Electra/C-130 tie-up definitely affected the Lockheed success here. The same might very well occur with the big helicopter. The situation here is that by Ansett-ANA's £A5,000 interest, the Sikorsky people have the lead of the field. The Vertol agents are at work to push the 107, with the advantage of earlier delivery.

Where is the Rotodyne? As far as I can see, it is too far away for any operator to be really interested other than theoretically. The potential for the helicopter operator in Australia still must be proved with machines now available. That could very well lead later to the Rotodyne, which is ahead of its field. In the small helicopter class, there is a very great need here for a twin-engine type with 2, 3 and 4 seats. Take the case of the Melbourne engineer who bought one of the traded-in TAA Hiller 12Cs. He will use it for business, but he will have difficulty in securing permission to fly over the city. If this aircraft had two small engines, he could do anything with it. There is a big market here for a small helicopter—say the Hughes type, at that price [$22,500—Ed] and economics—with two small engines. This would make it possible to operate in the built-up areas and would start a rash of roof-top heliports. The trouble is, of course, that two engines might price the helicopter out of the field, but there should be some solution to this. The Australian problem cannot be unique.

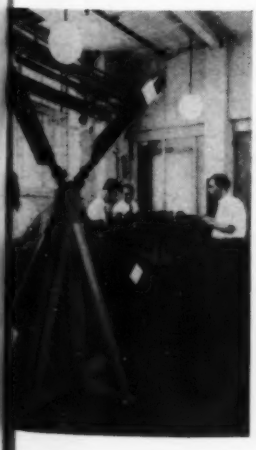
WESTLAND MAINTENANCE SCHOOL

SINCE its foundation in 1948 the Westland Aircraft helicopter maintenance school at Yeovil has trained just over 1,000 engineers to maintain Westland helicopters. Many of the students have come from the RAF, some from the Fleet Air Arm—although the FAA tends to train its own technicians—and the remainder from areas as widely dispersed as Japan, Brazil, France and the Persian Gulf. Westland set out primarily to train qualified aircraft engineers in the maintenance of their helicopters both to assist the operators and to ensure that the machines are correctly cared for after leaving the factory. On satisfactorily passing the course, the engineer receives a certificate and is able to complete all field maintenance up to check 4 standard. Some 70 per cent of an operator's staff is generally trained in this way.

Intervals between courses are sometimes employed to give refresher training; and a special five-day course is provided for ARB surveyors requiring helicopter experience. The main burden of school work now concerns the Whirlwind, used by the RAF and civil operators, and the Wessex, which is entering service with the Fleet Air Arm. A four-weeks' course covers the Whirlwind while a similar course on the Wessex airframe is supplemented by a three-weeks' course on Wessex electronics and autopilot. Dragonfly and Widgeon courses are still occasionally run.

The school has several well-appointed, modern classrooms equipped with comprehensive ranges of components and working diagrams of complex parts. In another special room is a complete Whirlwind centre-fuselage and transmission, the fuselage floor being separately displayed to illustrate the complete fuel system and techniques for location and repair of various forms of damage. Nearby is a complete set of parts, an assembled transmission, soon to be sectioned, and the rotor head and tail-rotor of a Wessex. The actual components are well supported by drawings and diagrams and comprehensive lecture notes are issued to and kept by each student.

The school is controlled by Capt H. A. Traill, the Westland Group service manager, who has now also become responsible for equivalent schools run by the companies which have recently joined Westlands. Chief instructor at Yeovil is Mr T. Crockett, formerly an RAF instructor; and Mr B. Cunningham, formerly with the Fleet Air Arm, assists him.



Two instructors at the Westland school (left and second from right) explain the Wessex tail rotor and main rotor-head to students; below (l to r) Capt Traill, Westland Group service manager, Mr T. Crockett, chief instructor, and Mr B. Cunningham, instructor in one of the classrooms; and below (right), students examining the Whirlwind transmission and rotor head in situ, with some of the components of a Wessex transmission on display

Recently off the production line at Schiphol is the Dutch royal Friendship, personal transport for Queen Juliana

Keeping Friendship Up-to-date

FOKKER LOOK AHEAD

FOKKER are giving serious consideration to a Friendship that is 7ft longer than the present design, weighs 42,000lb and would in some versions be powered by Rolls-Royce Dart RDa.10s. For military use a swing-tail version of the present Freightship is under discussion. Also projected is another military version with considerably improved field performance.

The stretched-fuselage aircraft would be broadly the same as that being offered to Eastern Air Lines by Fairchild; both factories work in very close harmony on Friendship developments. The present Friendship is not structure-limited and Fokker have realized for some while that for moderate climates a more efficient aircraft would result from an increase in the present Friendship's size and weight. The stretch envisaged would allow another two rows of seats to be installed, to bring the standard total to 48, plus an additional 1½ft for freight. Broadly speaking, the matched powerplant for the Long Friendship (*Flight*'s suggestion for a name) is the Rolls-Royce RDa.7—the engine of the present 200 series aircraft—but for hot and high climates performance can be restored by specifying the RDa.10.

Eastern's reasons for proposing the RDa.10 powerplant are different; the most powerful Dart would allow them to save an estimated $1m a year by dispensing with water methanol. This order is an important one indeed, not only to Fairchild (see *Flight*, June 10, 1960) but also to Fokker. The Dutch firm will go ahead with the Long Friendship in any case, but upon the Eastern order will depend how this is done. If an order from Eastern is forthcoming in the very near future, it is to be expected that the airline will ask for the minimum number of structural and installation changes to complete the stretch. On the other hand, if there are no immediate orders to be filled—but promise of some—Fokker's technical staff hanker after more major design changes that would bring the Friendship thoroughly up to date and allow a number of "state of the art" improvements to be included. Developing structural knowledge might make some retooling necessary, and while the airframe as a whole was being reconsidered, better sound-proofing (by building in anti-resonance dampers) and provision for a dP increase from 4.2 to 5.5lb/sq in could be incorporated.

The stretched aircraft would have extra length built in both ahead of and behind the wing, but because the tail arm would be increased, no tail changes are likely. On the other hand, the undercarriage would have to be altered, both on the score of additional load and because present Friendships are a shade light on the nosewheel at aft c.g. and sweeping back the wheels would effect an improvement.

During a recent *Flight* visit to Schiphol it was explained that stretching on a "least-changed" basis might take say, 200,000 engineering man-hours; a full-scale programme could occupy three times as long. What course of action the factory will pursue is, naturally, a major policy decision that will depend upon Fokker's other commitments. Fairchild's possible order from Eastern is one of them; Fokker work on the Breguet NATO project, the Atlantic—for which they are building the centre section—is another. A third might be the so-called "STOL" version of the F.27, discussed on these pages on June 10, 1960, in relation to Fairchild. Reference to this aircraft (Fokker, who originated the idea, call it the F.27S) is made later.

Discussion of Friendship improvements leads to questions of structural experience with the design after 150,000hr have been flown in service. "The wisdom of hindsight after five years," said I. C. van Meerten, Fokker's chief engineer in charge of the Friendship project, "leads us to think that the decisions we took in 1953 were the right ones." He had "no hesitation" in saying that the high wing was the correct choice. There was a real aerodynamic advantage, there had been no objections from operators in wintry northern latitudes (he cited Wien Alaska) and safety had been proved on the six occasions when, for one reason or another, a wheels-up landing had had to be made. Damage had occurred to the fuselage belly, propeller tips and—as the aircraft settled—to wing tips, but nacelles and fuel tanks had remained untouched.

What about the Friendship's structure, particularly the multi-laminated bonded-sheet-metal technique? How did this measure up to the fail-safe knowledge of 1960, seven years or more after the Friendship was conceived? "Of course," said Mr van Meerten, "fail-safe knowledge then was not what it is now. We have done a lot of work on the structure and it has been made fail-safe with a proven 30,000hr safe life; we used a statically indeterminate structure and the result has been made quite satisfactory. Nevertheless in the light of present knowledge we should look more towards static determination of individual members for fully fail-safe design. We might, for example," he added, "alter the tension side of the wing structure, and there are some critical detail parts where more fail-safe design could now be applied."

About metal bonding Fokker were very happy. Mr van Meerten said that it was being used on the Breguet Atlantic. But, he said, nowadays greater use would be made on the F.27 (if time could be put back) of chemical milling, which was more refined and might be cheaper, as fewer parts were involved. Fokker had "full confidence" in bonding. It was light, could easily be reinforced, and stress-raising rivet holes were practically eliminated. Once bonding was right (and in the early days of the Friendship it had not been easy to get it right) it stayed right.

Independent confirmation of Fokker's belief in metal bonding primary structures was given by the firm's chief structural engineer. There had, he said, been 36,000 simulated flights on the test wing/fuselage combination and the fuselage had been put through 125,000 pressure cycles. After a long series of component tests and crack propagation studies, a non-fatigue-critical airframe had been developed. If the Friendship was started as a new project now, he said, "we should adopt broadly the same lines as before." Service and overhaul were in some respects not perhaps as easy as they might have been, and for his part he would advocate the adoption of more through-bolted structures. Never-

There is little evidence here of a slackening in the pace of Friendship production. In the foreground are the fuselages of two Freightships with large forward cargo door. The aperture is big enough to load a Dutch DAF car, which is about the size of a Mini-Minor

theless, bonded joints could conveniently be inspected with Fokker's Bond Tester. This had been adopted for the Atlantic.

The Avro 748 has been closely studied and the Dutch expressed great interest in the philosophy which the 748 structure represents. But this did not alter their own confidence in bonding, or of the value of maintaining a low stress-level throughout the structure; rate of crack propagation was what counted, and that depended upon the stress level and the point chosen on the S/N curve. Parallel members could defeat their own object because every attachment point implied a rise in stress level.

Fokker's early trouble with the centre section tension skin, *Flight* was told, has been the subject of continued fatigue testing by Fairchild, who have 50 aircraft flying with the original gauge of skin. They have now demonstrated 25,000 45min flights and hope to go on to 38,000. Dividing by a scatter factor of 2½, this would clear the aircraft for 15,000 flying hours. Fatigue testing on the original Fokker F.27 is now complete, but the test fuselage is now being used to determine the optimum skin gauge for the stretched fuselage at the higher dP.

Other-than-structural experience with the aircraft has been generally satisfactory. The unusual choice of a pneumatic system has been well justified and Fokker's air conditioning installation has proved a success. On the other hand, Fairchild's Freon-system experience is said to have been less satisfactory.

One difficulty for which the firm sees no easy solution is floor-life, which is now about 3,000hr. Stiletto heels are the trouble, and a readily detachable floor might be the easiest solution for maintenance—that or a fashion change.

Very wide use is made of plastic fairings for fillets, wingtips and so on in the Friendship, and contrary to earlier hopes the results have not been quite as satisfactory as first promised. Rain erosion and a peculiar susceptibility to lightning damage suggest that it might be better to replace one or two parts—such as wingtips—with metal pressings.

Earlier, reference was made to a "STOL" version of the Friendship, the F.27S, intended primarily for military use. Brief details of Fairchild's interest in this design were given in *Flight*, June 10, but the idea originated in Holland. Modifications to the basic design for this version are relatively few; they consist of a double-slotted flap, a variable-incidence tailplane and the 2,460 s.h.p. of the Dart RDa.8 (military version of RDa.7). Fokker hasten to point out that this would not really bestow true STOL performance, but would place the F.27 "in the Caribou category." [In which case it *would* be true STOL.—Ed.]

There is nothing much new about the double-slotted flap; it was included in the original prototype, but it gave greater lift and much more downwash than was expected, and it was abandoned because it gave rise to longitudinal control problems. The double-slotted flap will now be mechanically connected to a v.i. tailplane and the prototype aircraft is now in the shop with its tail removed for these mods to be incorporated. It should fly again in August or September. With military markets in mind Fokker also have paper-studied various rear-loading ideas: clamshell doors, upward-opening doors with ramps and so on. Most widely favoured is the swing tail; it is the easiest to pressurize and could be accomplished for a weight penalty of only 350lb.

This account of Friendship activity in the summer of 1960 cannot be complete without a reference to the after-sales organization responsible for the 80-odd Fokker F.27s which are now on order. The basic servicing techniques of pilot and airline personnel training, factory representation during introduction of the type and so on, are all practised by Fokker, who in addition are to run this year their first F.27 Operators' Conference (Fairchild held their first last year). F.27 customers will meet at Schiphol in October and should find it as useful a sounding-board of Friendship experience as the Vickers' conference is for the Viscount. In addition it may offer the factory a chance of discussing the projects.

Part of the interior of the royal Friendship — an exercise in quiet restraint

The system of serviceability recording that Fokker have adopted seems particularly efficient. Every Fokker field-service engineer carries in his pocket a pad of dockets of the type shown below. When a snag occurs he merely rings items in the various sub-sections and despatches the docket to the factory. No further report is needed. Thus should, for example, a flap operate incorrectly during the approach, he might ring, say (1) approach, (2) pneumatic, (3) flight test, (4) low pressure, and so on. At the factory the information is transferred to a punched card and printed off in code; each fortnight a serviceability record with troubles grouped under code headings is run off and from this primary causes of unscheduled removals can be easily traced. Fokker would very much like to see this system adopted by each airline flying the F.27, but most have systems of their own.

While ATA specifications are accepted in principle for parts provisioning, ATA 100 was not available to Fokker when the F.27 first entered service and a procurable parts list—if anything more comprehensive than the ATA specification and exceptionally well illustrated—is issued to each new operator. As might be expected, advice on suitable spares holdings is always given with information about spare-parts supply. The situation is slightly complicated by the use of many foreign (British) components in the aircraft and, sad to relate—say Fokker, not all British component manufacturers are quite up to the rapid-supply standard set by the best. Fokker themselves are open twenty-four hours a day for the supply of urgent spares, and contact with technical staff may be made at any hour of day or night. They very reasonably add, though, that they are not the best people to ask about the efficiency of the Fokker system.

A final example illustrates the changing pattern of service. Where, until recently, Fokker established the priority of any modification, they now only "recommend" a modification or suggest it as "optional." The "mandatory" idea has disappeared completely and the onus of safety is now placed on the operator, overlooked by his national airworthiness authority. A. T. P.

[A note on recent Friendship orders and an F.27 order book appears on p. 100.]

Friendship trouble-shooting report pads are carried in the pocket of every Fokker field-service engineer. At the factory the information is transferred to punched cards and printed off for regular inter-departmental distribution

RE-PLY	CLASS URG	CLASS ROUT
YES	1	3
NO	2	4
80	TEL	5

FOKKER F-27 TROUBLE REPORT Part Name ——— Operator ——— (2-3) Date ——— (4-5) Report No. ——— (6-8)

Mark ——— (9-10) A/C SN ——— (11-13) Part No. ——— (14-30) Part SN ——— Part Issue No. ———

Time in Service ——— (31-35) Time Since Overhaul ——— (36-40) Vendor ——— (41-43) Location/App. No ——— (44-50) Publication eff. ——— (51)

Flt Delay (Min) ——— (52-55) Pictures supplied [YES] Info supplied [YES] Date of Trouble ——— A/C Total Hours ———

AIRCRAFT POSITION
56 - 0 Approach
1 Climb Out
2 Cruise
3 Gnd. Handling
4 Jacking
5 Landing
6 On Ground
7 Take-Off
8 Taxiing
9 Other (Amplify)

PRIMARY CAUSE
57 - 0 Electrical
1 Fw'n Obj. Damage
2 Maintenance
3 Material
4 Mechanical
5 Operational
6 Pneumatic
7 Quality Control
8 Servicing
9 Other (Amplify)

WHEN DISCOVERED
58 - 0 C/W Publication
1 Enroute Inspect.
2 Flt. Ops.
3 Flt. Test
4 Inspection
5 Installation
6 Pre-Flt./Daily
7 Prevent. Maint.
8 Reading
9 Other (Amplify)

SYMPTOMS OF TROUBLE
59 - 0 Excess. Press.
1 Excess. Temp.
2 Flame-Out
3 High Voltage
4 Inoperative
5 Leakage
6 Low Press.
7 Low Voltage
8 Overspeed
9 Vibra./Shimmy

60 - 0 Contamination
1 Desiccant Ind.
2 Discoloration
3 Excess. Press.
4 Fire
5 Interfer./Binding
6 Loose
7 Low Temp.
8 Press. Loss
9 Unstable/Surging

61 - 0 C/B Popped
1 Corrosion
2 Instr. Ind.
3 Lost Press.
4 Noisy
5 Oversized
6 Prop Feathered
7 Undersized
8 Visual
9 Other (Amplify)

CORRECTIVE ACTION
62 - 0 Customer Advised
1 Mod on A/C
2 Publ C/W
3 Readj. on A/C
4 Rem/Mod/Reinst.
5 Rem/Readj/Reinst.
6 Rem/Rep/Reinst.
7 Rep. on A/C
8 Repl/W serv. Item
9 Other (Amplify)

REASON FOR REPORT
63 - 0 RLD Publication
1 Emerg. Landing
2 Emerg. Proc. Used
3 FOK Publication
4 Flt. Deviation
5 Incident
6 Premature Removal
7 Quality Control
8 Supply Report
9 Time Change

64 - 0 Accident
1 Alterations
2 Depart. Delay
3 Flt. Crew Rept.
4 Maint. Rept.
5 Performance
6 Procedure
7 Publ.Error
8 Weight & Balance
9 Other (Amplify)

DISPOSITION OF PART
65 - 0 Mod/Ret. to Stock
1 Overhaul Ret./Stk.
2 Rep./Ret. to Stock
3 Ret. to FOK
4 Ret. to Stock
5 Ret. to Vendor
6 Salvaged
7 Scrapped
8
9 Other (Amplify)

ENVIRONMENT
66 - 0 Dust
1 Fungus
2 Hail
3 Heat
4 Sleet
5 Snow
6 Rain
7 Salt Air
8 Sand
9 Wind

67 - 0 Blowing
1 Cold
2 Dry
3 Extr. Temp. Change
4 Freezing
5 Heavy
6 High
7 High Humidity
8 Torrential
9 Other (Amplify)

DISCREPANCIES FOUND
68 - 0 Broken
1 Chafed
2 Dented
3 Discolored
4 Distorted
5 Excess. Wear
6 Inoperative
7 Low Indication
8 Noisy
9 Seared

69 - 0 Bent
1 Corrosion
2 Creased
3 Disintegrated
4 Galled
5 Gouged
6 Incorrect Part
7 Out of Tol.
8 Pub. N/C/W
9 Undersized

70 - 0 Burned
1 Contaminated
2 Cracked
3 Cut
4 Disconnected
5 Erosion
6 Excess. Ind.
7 Leaking
8 Low T.O.P.
9 Unstab./Surg.

DISCREPANCIES FOUND
71 - 0 Blocked
1 High T.O.P.
2 Install. Error
3 Metal in Sump
4 Missing Parts
5 Pitted
6 Pulled Out
7 Seized
8 Vibra./Shimmy
9 Water Entry

72 - 0 Excess. Vibra.
1 Fire
2 Frayed
3 Inaccessible
4 Insuf. Pressure
5 Open Circuited
6 Shorted
7 Stretched
8 Stripped
9 Undersized

73 - 0 Elongated
1 High Pressure
2 Internal Failure
3 Locked/Jammed
4 Low Pressure
5 Low Voltage
6 Out of Balance
7 Ripped
8 Shrinkage
9 Wrapped

DISCREPANCIES FOUND
74 - 0 Binding
1 Bonding Sep.
2 Cycling
3 High Voltage
4 Loose
5 Maladjust.
6 Overheat
7 Overtorqued
8 Sheared Shaft
9 Skin Cracks

75 - 0 Arcing
1 Blown
2 Baffeting
3 False Ind.
4 Low Power
5 Out of Phase
6 Out of Track
7 Rivet Failure
8 Too Long
9 Too Short

76 - 0 Buckled
1 Carbon Deposits
2 Erratic Ops.
3 Exhaust Entry
4 Exting. Disch.
5 Lightning Dam.
6 Out of Synch.
7 Undertorqued
8 Unsafeties
9 Wear Checked

DISCREPANCIES FOUND
77 - 0 Fus. Press. Leak
1 Hail Damage
2 Inadvert. Disch.
3 Lost
4 Malfunction
5 Misalignment
6 Oil Starvation
7 Oversized
8 Syphoning
9 Twisted

78 - 0 Chipped
1 Collapsed
2 Excess. Lag
3 Drag
4 Kinked
5 Lack of Lubr.
6 Unserviceable
7 Oxidized
8 Torn
9 Weak

79 - 0 Delamination
1 End Play
2 Excess Clearance
3 Heat Treat. Error
4 N/Interchangeable
5 Ruptured
6 Screen Defects
7 Slips
8 Sluggish
9 Other (Amplify)

SUPPORT AND SELL

A Plan for Parts Service

By G C. SCOTT

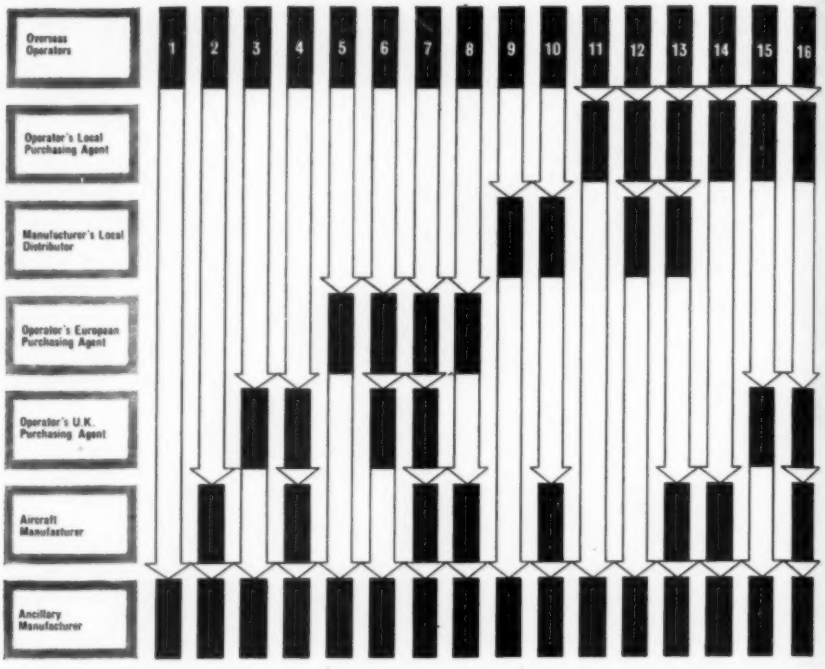


Fig 1. WHEREPART? The overseas operator may use one of eight paper-work routes to order parts for a British civil aircraft. Rarely does he find the direct route to the component manufacturer concerned

IN "Flight" for October 16, 1959, appeared an article—"Sell and Forget"—which reviewed the aircraft and component manufacturing industries' mixed record in the field of after-sales service. We believe that it had considerable impact and that its lessons were well received. Here the same writer advances a plan for co-ordinating British after-sales effort.

"THE aircraft industry will be dead unless it can export on a large scale," said the Minister of Aviation in a recent speech. Of more immediate importance is for the industry to keep on exporting at all. Reduced now to the level of a few more Comets and Viscounts, twenty-three Vanguards, seven Argosies, five Rotodynes, plus a few minor odds and ends, we are getting alarmingly near the bottom of the export order barrel, and the present rate at which the barrel is being replenished can hardly be described as encouraging.

The Minister's advisers seem to consider that the problem will be solved by the rationalization of the industry's financial structure, and that once everyone has sorted himself out, following this fission-fusion process, the customers will be knocking each other down in the rush to place orders. But is there any reason to suppose that operators contemplating placing orders with manufacturers in the USA, France, or the Netherlands—in whom they have complete confidence today—are now going to wait until tomorrow, on the chance that things might improve with British firms? We must face the fact—as M. J. Hardy pointed out so effectively (*Flight*, January 29, 1960)—that there are operators today who have no confidence in our industry, and there is no guarantee that their faith will be restored with rationalization.

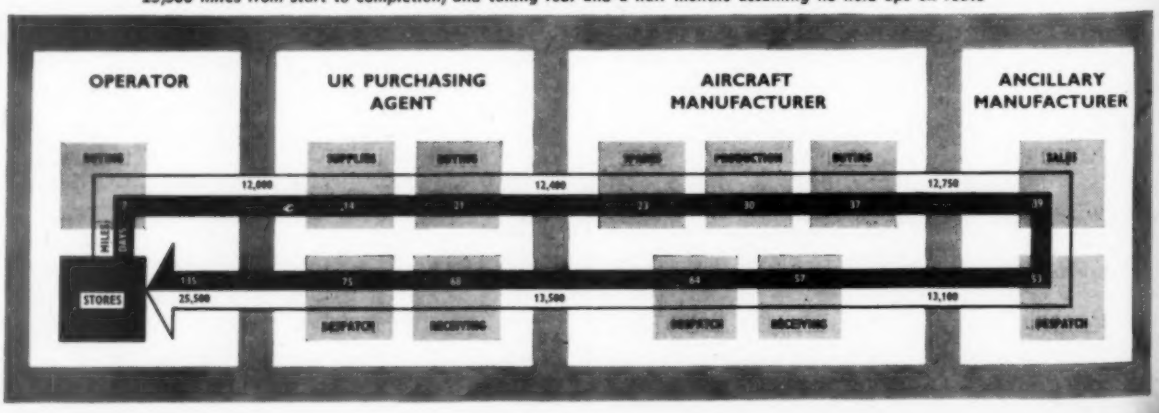
So often do we hear the cry "if only the Government would give us some money. . . ." There are British aircraft for which Government assistance has been provided, either directly or indirectly, on a very massive scale. But it does not appear to have made much impression upon the export order books. Twenty Britannias, twenty-two Comet 4 series, and twenty-seven Twin Pioneers is hardly "export on a large scale," considering that it has taken at least four years to accumulate these orders. Compare this with 58 Caravelles, not to mention other competitors from the USA and the Netherlands. In fact, Britain's best-seller, the Viscount, is the only British commercial aircraft for which there has been no massive Government assistance, and no Government orders at all.

Funds for After-sales In a previous article (*Flight*, October 16, 1959) it was suggested that the industry would have to eradicate any "sell and forget" tendencies before it could hope to export with a reasonable prospect of continued success. It is not sufficient for an aircraft by itself to be good; the whole organization behind it must be good, and customers must know it to be good. Design, production and salesmen finish their main job when the aircraft are delivered to the operator, but for the spare parts men there should be at least ten years' work ahead after sale.

At present vast sums of money are lavished upon design and research, production and sales; but, because accountants resist expenditure on "non-productive" labour, relatively little is authorized for the development of efficient spare parts organizations.

In their exhortations to "sell more spares," managements are to some extent conscious of the value of spares; but clerks cannot compete with computers, and the industry must be prepared to

Fig 2. SLOWPART! The meanderings of a routine order for parts from the Far East, involving at least twelve intermediate stages, covering 25,500 miles from start to completion, and taking four-and-a-half months assuming no hold-ups en route



SUPPORT AND SELL...

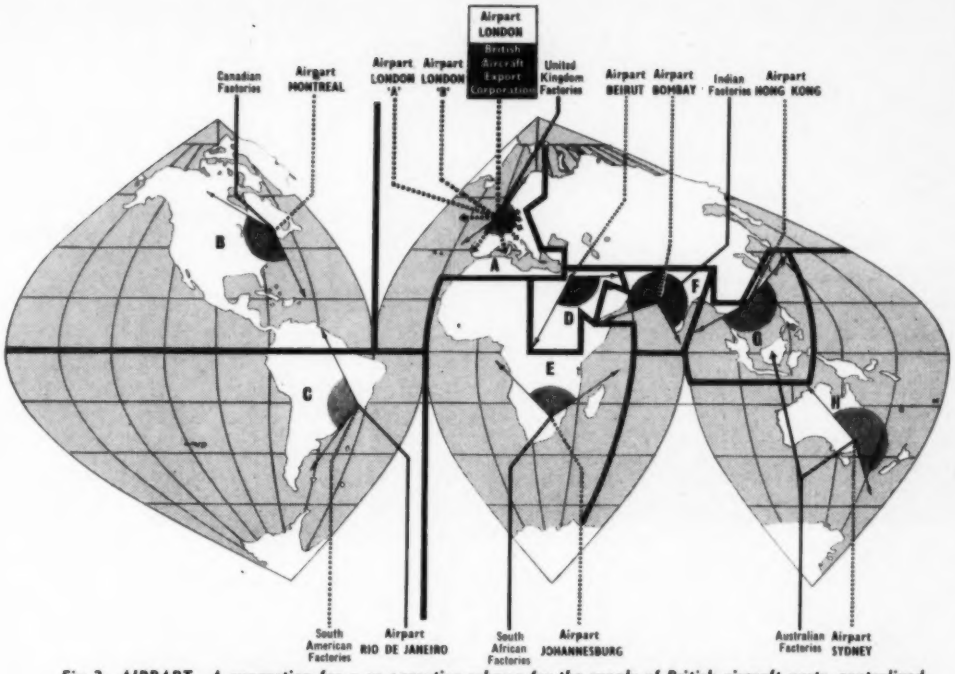


Fig 3. AIRPART. A suggestion for a co-operative scheme for the supply of British aircraft parts, centralized into one customer in Britain. Airpart, London, would supply to centres in A, Europe; B, North and Central America; C, South America; D, the Middle East; E, Africa; F, Mid-Asia; G, the Far East; and H, Australasia

spend a lot more money on modernizing and streamlining the whole spare-parts system before the operators will be prepared to agree that British aircraft are competitive, not just at Farnborough, but throughout their operating lives. To spend all available funds on pre-sales effort makes about as much sense as to commit all the Army's reserves to battle on D-day and at H-hour.

If the Minister allocates millions to the rationalized groups with the object of exporting the new generation of British civil aircraft, then he should insist that a substantial sum is witheld from pre-sales and devoted exclusively to the modernization of the industry's spares support. This should be started immediately, and should include the ancillary manufacturers. At least 150 companies in this country produce aviation components which require some degree of parts service, and collectively these firms have an unsatisfactory reputation for supporting their products after sale. To sell today we must support, and if we support we shall sell.

System of Supply There are a few stages of the industry's parts-sales service where injections of modern equipment and ideas are not urgently needed, and a complete manual would be required to cover every aspect of the subject. The purpose of this article is to suggest a co-ordinated and recognizable *system* (rationalization, if you must) for the supply of parts to the operators of British aircraft in every country in the world.

The first object would be to ensure that the civil operator's convenience was the first concern of the whole industry. Even the smallest operator must know where he can obtain any part he requires, and further, know that he will get it when he wants it. Secondly, we should stop the Ministries overloading the industry's spare-parts capacity. A customer for parts should be created who can speak for all the civil operators with a voice more powerful than those of all the Ministries lumped together. (As things are now, the still, small voice of the bush operator calling from the African jungle for a vital tab-washer is liable to receive scant attention when the parts manager's office is full of Ministry men on an all-day progress conference.) Thirdly, the foreign agents supplying aircraft parts on a fat commission as a sideline must be eliminated from the system.

In considering this business of supply we should first of all take a look at what is happening now. Fig 1 illustrates something that is alas, fact; a system that is actually in operation today for the ordering and supply of spare parts for British civil aircraft. The word "system" is meaningless in this context, for the one thing that the picture does illustrate is that there is no system. There is just a series of haphazard arrangements, usually concocted by the salesmen and the middleman, and so full of built-in disadvantages that efficient operation is impossible.

Middlemen As a rule, the operator's requirements for parts of proprietary manufacture exceeds by a considerable margin, in the number of items on one order, those produced by the airframe manufacturer. Despite this, there are an incredible number of middlemen (overseas agents, European agents, UK agents, and the airframe manufacturer) interposed between the operator and the ancillary manufacturer. Very seldom is there direct contact between the two.

Carrying this a stage further, Fig 2 illustrates the progress of a routine order for a proprietary part, from an operator in the Far East who has specified delivery by sea. This order is processed through no fewer than fourteen stages, not including the railways, shipping people, Customs and so on; and approximately 75 days —two-and-a-half months—elapse from the time the stores demand arises with the operator until the departure of the goods from this country. This does not allow for any delay due to stock shortages in the factory, and does not include the transit time to the Far East. An AOG demand is of course usually satisfied much more promptly, although at some cost in delay to less urgent orders. As all else can come to a standstill for an AOG, customers who do not use the magic letters have to wait even longer, and still the fourteen middlemen have their little parts to play.

Services Supplies The writer has already criticized the methods used by the Ministries in the procurement and progressing of aircraft parts. Nevertheless, the industry could learn much from the Services in their system of supply of stores around the world. In the Royal Air Force in the UK for example, the factories deliver direct to maintenance units. The maintenance units ship the stores abroad, and the overseas squadrons (the operators) draw parts and equipment from their nearest MU; overseas squadrons never order parts from the home factories. This is a system which has been developed over many years, with the object of operating efficiently under the emergency conditions of war. It is one which works because it has been made to do so.

A similar system could be introduced with advantage on the civil side. A suggestion for such a system is illustrated in Fig 3. The world has been divided into areas, North and Central America, South America, the United Kingdom, Europe, Africa, the Middle East, Mid-Asia, the Far East, and Australasia. A parts distribution centre is located at an airways focal point in each area: Montreal, Rio de Janeiro, London, Johannesburg, Beirut, Bombay, Hong Kong, and Sydney. London is split into London A, distributing to operators in the United Kingdom only, and London B, covering the remainder of Europe. B could for convenience perhaps be located at Gatwick, and A at London Airport. Also at London Airport would be the main distribution centre for the whole system.

(To be concluded)

"Flight" photograph

Painting the lily? Nearly 30 different modifications have been made in developing the Chipmunk up to its present standard. Maximum true airspeed is over 120kt

MASEFIELD CHIPMUNK in the Air

By ALASTAIR PUGH

No 130 of the Series

IT must be an open secret that the modifications which have added about 10kt to the speed of Mr Peter Masefield's Chipmunk were made with half an eye to the design of a new British light aeroplane. The Bristol design which provided some of the justification for the long list of modifications came to a standstill with amalgamation and has presumably since been shelved by the British Aircraft Corporation. Nevertheless there are a number of well-documented modifications on Chipmunk G-AOTM which would provide a reservoir of information and experience should it ever be required. This is not to say that all the alterations to this attractive little aircraft have been made with such lofty intention. Many are intended simply to improve its practicability for touring.

When I arranged to fly the "Masefield" Chipmunk at Gatwick it was some years since I had last flown a Chipmunk of any sort, and to provide a basis for comparison I rapidly arranged an hour's flight in a completely standard trainer. My impressions refreshed, I had a quick dual flight in Tango Mike and then settled down with Mr Masefield to finding out what the differences were before setting off on a more leisurely analysis.

The Chipmunk was bought almost new by Mr Masefield for Bristol Aircraft and subsequently purchased from them for his own use. There are now no less than 28 modifications and additions, the major ones being the big moulded canopy and long windscreen, coarse-pitch Gemini metal prop and two different versions of spats developed in the Bristol wind tunnel. The stainless-steel exhaust manifold fairing and pressure-sealed flaps are also significant items. These five modifications are responsible for most of the Chipmunk's increase in speed; maximum mean TAS recorded over a measured course is 121kt. Other modifications include a 44-channel STR-9Z radio; larger generator; faired-in Grimes rotating beacon on top of the windscreen; motor-car flashing light under the fuselage; Bristol Plastics glass-fibre spinner and nose-cowl; boost gauge; sliding map and sandwich drawer in the front cockpit; Crooks glider-type compass; baggage compartments with a total capacity of 8 cu ft in the top surfaces of each wing; flush navigation lights; deletion of the oil cooler scoop; internal Ki-gas primer and electric starting; twin batteries; rudder pedal stirrups; rain deflector and extended fresh-air duct; detail attention to fairings, controls and under surfaces; altered crank throw position to spark relationship; and an extended ram-air carburetter scoop. It might be added the Chipmunk is very neatly trimmed with Day-Glo paint and is *always* seen highly polished.

The Chipmunk has thus not been developed for out-and-out high speed. Addition of the Grimes beacon in the cause of safety cost 4kt in performance, and raising the canopy 3in above the line of the standard windscreen frame should have cost a further 6kt. In fact, lengthened windscreen and canopy together resulted in a 2kt increase in maximum speed. Another spectacular improvement resulted from adding the spats. The first one was designed by eye and tailored to leave the leg and brake in the open. It gave an increase of 3kt and the all-enveloping starboard spat—a later addition—is worth a good bit more. When the extended spat was first fitted its effectiveness could be felt as an adverse yaw.

Our protracted pre-flight inspection complete, I was anxious to be off. I jumped into the front seat, slid the big canopy to its fresh-air position one inch open, clipped in the quick-adjusting shoulder harness and took rapid stock of the cockpit. Apart from a white interior finish and the addition of extended map pockets in front of the seat and on the starboard side of the fuselage the layout is essentially familiar. There are a number of instrument additions though, including the Crooks compass attached to the lower lip of the panel and two rows of extra instruments along the coaming—generator and cylinder head temperatures forward and clock, boost gauge and stopwatch aft. A Masefield addition is a bungy chord "autopilot" stretching from side to side of the cockpit. It has a loop in the middle that normally serves as a control lock but which in cruising flight can be slipped over the stick to hold it more or less central. Like all the best autopilots it can be overpowered by the pilot.

Starting and priming are straightforward and taxying just the same as in any other Chipmunk. There is some distortion from the sides of the long windscreen, but the canopy can be left open.

Except for cruising the choice of propeller seems a slightly unhappy one. Solo and with 19gal fuel on board I made two take-offs from longish grass, one with flap and one without. Times to unstick were 18sec and 19sec respectively. These are quite protracted at the weight at which I was flying—and approval has been given for operation of the "Masefield" conversion at up to 2,200lb gross weight. Unstick speed was about 45kt with 15° flap and 50kt clean; and the climb a little sluggish in comparison with the standard aircraft. I climbed the stairs between 2,000ft and 5,000ft in my club aircraft in 3min 23sec at full throttle and a steady 65kt. The Masefield Chipmunk required 3min 54sec although, to be fair, a better rate of climb is achieved with the heavier aircraft at 70kt than at 65kt. From the front cockpit there is practically no advantage in view to be gained from the big canopy. As on the standard version the restriction remains the windscreen frame. On the other hand there is a considerable improvement in view for the rear seat passenger.

During the climb I made my first attempts at assessing the effect of the modifications on the Chipmunk's handling. Pitch damping of the heavier aircraft after a deliberate displacement seemed to be of slightly longer period but less amplitude than standard. I also gained the feeling that this was a slightly heavier aircraft to handle, but a quantitative assessment might have to be very accurate to show variations of sufficient magnitude to supplement these impressions. I recorded 46kt as the clean stall speed of the Masefield Chipmunk and 45kt for a standard aircraft; but this difference, although on the right side, could be accounted for by calibration errors. The buffet threshold in each case was about 50kt. Stall, power off with 10° flap, occurred at 42kt and with full flap at 36kt; but I was not able to get much under this speed even with the throttle wide open. There are certainly no adverse traits at the low-speed end of the scale.

One of the most marked differences in handling is undoubtedly in the spin. I found that the Masefield Chipmunk entered the spin rather more easily than the standard aircraft, stabilized quickly and appeared to rotate at a constant rate. After three turns there was no sign of flattening off or the pitching that I had noticed with the club aircraft; a spin was a pleasantly normal manoeuvre. Apparently this is an effect of the long windscreen.

The real interest of the modified Chipmunk is of course its speed potential. At 1,250ft a.m.s.l. at 2,000 r.p.m., the standard aircraft I tried would fly at about 93-94kt. The Masefield Chipmunk under similar conditions is at least 8kt faster and at full throttle at the same height I recorded an indicated airspeed of 118kt. Taking

(*Concluded on page* 105)

AIR COMMERCE

ARGOSY MILESTONE

THE fourth Armstrong Whitworth Argosy, G-APRN, completed 300hr of route-proving flights in the early hours of July 7 with an overnight return trip to Barcelona. Operating at a utilization equivalent to 2,500hr a year, say AWA, "the Argosy maintained a high order of serviceability and kept to a rigid timetable." The only delay for which the aircraft itself was responsible was one of 1½hr at Beirut when (as reported in *Flight* on June 24) a chafed fire warning wire was quickly replaced.

The longest flight by G-APRN in the proving series was one of 6hr 5min from Birmingham to Malta, and the most intensive period was one of 16 hours' continuous flying during which the aircraft flew Beirut - Cairo - Beirut - Athens - Rome - Birmingham with only brief stops for refuelling.

At the end of next week, July 16, an Argosy is to be flown to India for demonstration to the Indian Air Force and to IAC. IAF interest, it is understood, stems from a visit by a Hawker Siddeley sales team last November and is sharpened by their requirement for a transport aircraft replacement for their Fairchild Packets. This would presumably be met more closely by the AW.660 than by the AW.650.

The aircraft will reach Delhi via Rome, Athens, Beirut and Karachi and it will carry 4,000lb of Avro 748 components for delivery to Kanpur, where these aircraft are to be built. Included on the itinerary of the 10-day visit are Calcutta, Hyderabad, Bangalore and Bombay, and the Argosy will return through Karachi.

THE VC12

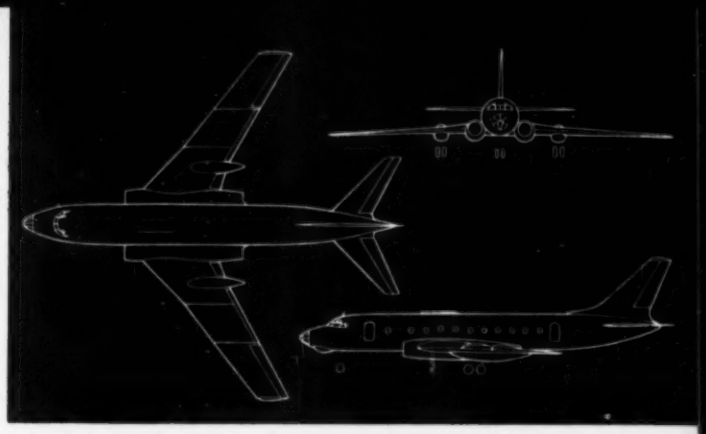
ACCORDING to a report in the *Daily Telegraph*, the British Aircraft Corporation is to revive design and development work on the 44-55 passenger Hunting 107 short-range jet (two Bristol Siddeley BS75 turbofans). It may be designated VC12 and would be a "Viscount replacement" of Viscount 700 size.

A full scale wooden mock-up of the H.107 was built two years ago at Hunting's Luton factory, and the most up-to-date figures were published in *Flight* for November 20, page 609. At one time in 1958 the H.107 seemed likely to become an Airco project, Hunting Aircraft being a member of the subsequently dissolved consortium which was responsible for the D.H.121. It would have been the short range (200-750 mile) partner for the D.H.121. But if the BAC now goes ahead with the H.107/VC12, it could be a partner for the medium-range VC11—assuming that that project is proceeded with, a matter not yet decided.

Probably the Corporation's efforts will be concentrated upon one or the other, and a matter that obviously has to be considered is whether the VC12 or the VC11 is the project least likely to overlap the D.H.121.

CUT-PRICE TO CYPRUS

AN application recently put to the Cyprus authorities—but not, it seems, to the ATAC—for the right to offer special low fares to Servicemen and their families flying to London is described by the MoA Parliamentary Secretary, Mr Rippon, as "probably a little optimistic." He was asked last week by Mr Collard (Con and Nat L, Central Norfolk) whether he did not think that the BEA concessional return fare of £60 was "rather high" and that some competition might have the effect of reducing it, to the benefit of Service families in Cyprus.



This "Flight" provisional general-arrangement drawing depicts the Tu-124, the 44-passenger medium-haul turbofan transport now starting production in Russia. It bears the characteristic Tupolev stamp

Mr Rippon did not think there was any reason to believe that a better proposition could be put forward—though of course "it is always open to any airline to make a proper application."

It will be recalled that Falcon Airways applied last April (*Flight*, April 15, page 545) to the Cyprus authorities for permission to offer a £45 return fare using Hermes 4s at a weekly frequency. This application was not approved by the Cyprus authorities (*Flight*, May 20, page 701) on the grounds that such flights would "not be in the public interest."

COST OF THE CONVAIR 540

NINE months after Allegheny first placed the Napier Eland-powered Convair 540 into service it has reported to the CAB that cost per available seat-mile in the 52-passenger configuration was 1.8 cents. Total direct operating costs were 95.36 cents per aircraft revenue-mile and break-even load factor to meet direct costs on stage lengths of up to 178 miles was calculated to be 13-14 passengers.

A broad breakdown of costs shows that flying operations account for 45.15 cents per revenue mile, direct maintenance 29.57 cents and depreciation (calculated on 6½ hours' daily utilization at 240 m.p.h.) accounts for 20.64 cents. Each airframe is valued at $612,000 and is depreciated to a residual 15 per cent over a life of 120 months. Engines and spare parts are valued at $356,250 and depreciated to a residual 15 per cent of this after 60 months. Closer examination of the total cost of flying operations shows that pilots' salaries account for 17.58 cents per revenue mile, fuel 16.61 cents and engines 6.59 cents. Heaviest item of direct maintenance costs is the outside repair of the engines. This is reckoned by Allegheny to cost 18.05 cents per aircraft revenue-mile.

HOW GOES SAFETY?

LOOKING back over the decade 1950-59 *Flight* estimates that there has been an average of 26 scheduled-service accidents and 490 scheduled-service passenger fatalities per year. Last year, 625 passengers were killed in 28 scheduled flights, and the fatality rate was 1.06 per 100m passenger-miles. In 1958, 629 passengers were killed in 30 scheduled flights, fatality rate being 1.19.

The safety record of the US scheduled airline industry during the year ending May 31, was 0.82 fatalities per 100 million passenger miles, compared with 0.34 in the corresponding period of the previous year. The domestic services showed a 0.83 fatality rate and foreign and overseas services 0.80.

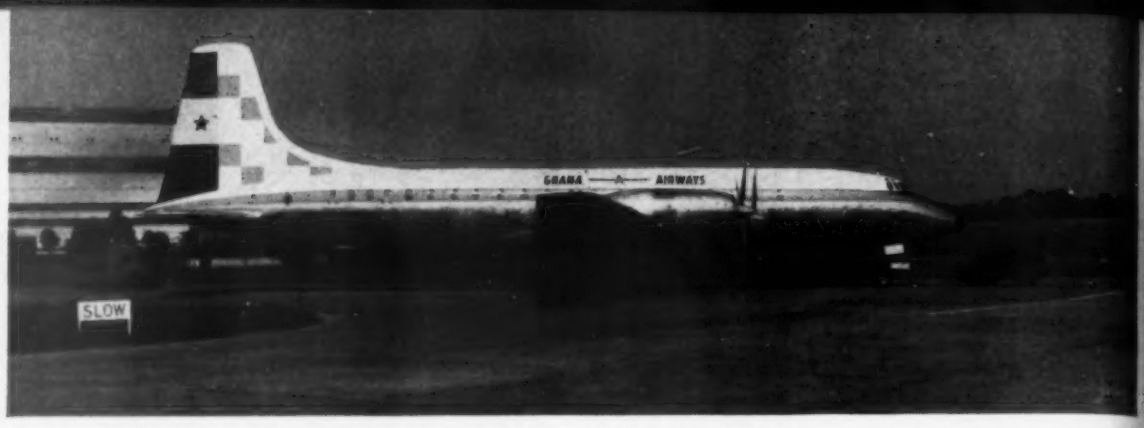
The British safety record for the period 1954-59 was reviewed in *Flight* for January 22, 1960.

BEA MAKE MONEY AGAIN

FOLLOWING a substantial increase of capacity, BEA's load factors fell in the early months of the financial year, but traffic continued to rise. There was a 30 per cent increase in passenger traffic in April, in May it was 18 per cent and in June 18 per cent again. "It seems," writes Lord Douglas in the BEA Magazine, "that we have made a good start to another successful summer."

BEA's chairman goes on to explain that last year's record £2 million profit was the balance of a £5 million profit in the seven months between April to October 1959 and losses of £3 million in the five winter months. Last year, he adds, BEA were near the limit of the traffic they could achieve without turning away an unacceptable number of passengers during peak periods. For this reason the corporation have planned to operate this summer at a load factor a few points lower. The present fall is the first since November 1958.

This is part of the 11-passenger interior (looking aft) of the Sikorsky S-62, the first turbine helicopter to be certificated by the FAA for commercial operations under its new—and stringent—helicopter transport regulations. The signing took place on July 6



Just out of the paintshop at Filton is the Britannia 305 ordered by Ghana Airways last March and now soon to be handed over. The cheatline is blue outlined in red; blue is used again on the fin chequerboard and the rudder is divided into red, yellow and green panels

AIR COMMERCE . . .

MORE FRIENDSHIP ORDERS

SINCE *Flight's* Airline Shopping List was published on January 8, 1960, Fokker orders for the F.27 have grown to 81 and Friendship orders to 83; the grand total is now 164. Though neither manufacturing organization has yet reached break-even point, Fokker at least are within striking distance; their target on present reckoning is about 100. Included in the list below for the first time are those operators who have specified the F.27 Freightship with the large forward cargo-loading door. Among them are KLM (both aircraft); Northern Consolidated (all three aircraft Freightships) and Pakistan International (one of five). The Royal Netherlands Air Force have ordered nine Troopships and three Friendships for executive transport and a number of these now occupy positions on the Schiphol production line (see page 94).

F.27 FRIENDSHIP ORDER LIST

(Correct to July 8, 1960)

Fokker-built:	Aer Lingus, 7; All Nippon, 3; Ansett-ANA, Airlines of NSW, Airlines of South Australia, Queensland, 7; Associated Airlines, 1; Australian Dept of Civil Aviation, 2; Braathens SAFE, 3; Helmut Horten, 1; Indian Airlines Corp, 5; HIM the Shah of Iran, 1; Iranian Oil, 2; KLM, 2 (2 Freightships); MacRobertson Miller, 1; Dutch Govt, 1; NZNAC, 8; PIA, 5 (1 Freightship); Philippine Air Force, 1; Philippine Air Lines, 2; Royal Netherlands Air Force, 12 (9 Troopships); TAA, 9; THY, 5; East West Airlines, 1; unannounced orders, 2.	81
Fairchild-built:	Abitibi Power & Paper Co, 1; Aerovias Equatorianas, 1; AVENSA, 5; Aloha, 6; Banco de Mexico, 1; Bonanza, 10; Butler Aviation (Pepsi Cola), 1; Champion Spark Plug Co, 1; Continental Can Corp, 1; General Tyre and Rubber, 1; Ideal Cement Co, 1; Johns-Manville Corp,1; Kimberly-Clark Corp, 1; Murray Co, 1; Noland Co, 1; Northern Consolidated, 3 (3 Freightships); Olin Mathieson, 1; Ozark, 3; Pacific, 6; Piedmont, 8; H. K. Porter Inc, 1; Quebecair, 3; Raytheon, 1; Reynolds Metals Co, 2; Reynolds Tobacco Co, 1; Trans Mar de Cortes, 1; THY, 5; Union Carbide, 3; US Steel, 1; West Coast, 6; Westinghouse Electric Corp, 2; John Hay Whitney, 1; Wien Alaska, 2.	83

BIG WIND AT DUM DUM

A VIOLENT gale that swept Dum Dum airport, Calcutta, last month left a trail of damaged aircraft and installations. No casualties were reported but about 20 aircraft were in collision or damaged by the wind, part of the roof was stripped from the passenger lounge in the terminal building and glass was shattered in the control tower.

Among the aircraft damaged was an Il-14 owned by the king of Nepal, nine IAC DC-3s and a Skymaster, and two DC-3s of Airways (India). Four light aircraft, including a Bonanza and a Rapide, were "caught in a spiralling current of air and dashed against each other." An abandoned Catalina was blown off the runway, and a gangway, driven by the gale, was dashed into the wing of a Thai Airways International DC-6. The gale swept an area of about three miles around the airport.

WHAT WAS THAT?

WARMLY recommended for those whose airliner recognition is in need of a little brushing up is the 1960 edition of John W. R. Taylor's *Civil Aircraft Recognition*.* A handy pocket-size volume, paper-backed, and splendid value at half-a-crown, it contains material on 88 civil aircraft and helicopters, 39 of them air transports. It is the section devoted to the latter which receives most prominence and descriptions of 36 commercial passenger and freight aircraft are supplemented with three-view silhouettes prepared by Dennis Punnett, whose work will be well known to readers of *Flight*.

With the exception of the Convair 240, 340, 440 and 540 series, and the various marks of Viscount, which receive two pages apiece, each air transport type is allotted a 5in × 7in page to itself. Included is a photograph, a brief table of data, silhouette and a well-condensed note about the development and service record of the type. A number of elderly aircraft are included (Air Charter's Supertrader conversion of the Avro Tudor, for example), some new ones (the Avro 748) and some that have yet to fly (VC10 and D.H.121).

Under the heading of "Other Types" are published photographs and brief descriptions of smaller aircraft which may be seen from time to time in Britain—the qualification was that at least three should appear on the *British Register of Civil Aircraft* when the volume was compiled. This section also includes British helicopters, two US ones (the Bell 47J and Hiller 360) and, in strange isolation, the Tu-114. Although alphabetical order by manufacturer is adopted for each section, an index is omitted.

Civil Aircraft Recognition should prove very useful. In particular it provides ready clues to solving today's big air transport recognition problem: was that a DC-8 or a Boeing 707?

* *Ian Allan Ltd, London. 2s 6d.*

FLASH POINT

AN interesting follow-up to a paragraph on the dangers of radar emissions which appeared in these pages recently ("Radar Has its Hazards," *Flight*, June 10) is contained in the June *Safety Bulletin* issued by the US Flight Safety Foundation. "What could have been a serious situation," quotes the *Bulletin* from a fleet operator's report, "was averted through alertness. Baggage was being loaded . . . when smoke was observed coming from a package awaiting stowage. Investigation revealed that it contained photo flash bulbs that had exploded and ignited packing material.

"Radar beams operating at the airport were suspected and to confirm this the engineering department conducted tests with and without the radar operating. They were able to flash the bulbs simply by holding them in their hands within range of the beams."

A flash bulb explosion was, it may be recalled, one of the theories advanced for the accident to Britannia G-ANCA near Filton on November 6, 1957. This hypothesis was given consideration in the report published on May 11, 1960, since glass particles were extracted from the cockpit and from the flying helmets of the crew members on board. The report also carried a photograph of a bulb bursting to illustrate "the consequential high-velocity dispersal of glass particles and burning magnesium." Careful analysis by Pilkington Bros Ltd revealed that, in this case, none of the glass originated from the type of flash bulb used.

The potential danger of bursting flash bulbs is commented upon, quoting the Britannia accident report, in the Flight Safety Foundation *Bulletin*.

Opening the fuel cock on the Shell-Mex and BP pipeline to London Airport is BOAC's chairman, Sir Gerard d'Erlanger. The ceremony took place at Perry Oaks on the LAP boundary last week (see "Flight," July 8)

A good view of Luton's new 08/26 runway, 5,532ft by 150ft, which has a load classification number of 45. A note about the opening of the new runway by the Minister of Aviation appears on this page

LUTON'S NEW RUNWAY

THE concrete runway that users of Luton airport have so long needed was opened by Mr Duncan Sandys, Minister of Aviation, last Friday, July 8. Luton Corporation are very proud of what they call their "new gateway to London, the Midlands and south eastern England."

Considerable development has been in hand over the last few years. The new runway (depicted in the photograph) and temporary Customs facilities are now in use, and plans are ready for a new terminal building. The airfield is open from 0830 to sunset plus 30min on weekdays, and 0900 to sunset plus 30min on Sundays. It is licensed for night flying, though until the installation of high intensity runway lighting and approach lighting is completed in the winter, goose-neck flares are available. (Notice for intended night operations should be given on the preceding day.)

Luton airport is only 30 miles from London (50min by road) and 30min by rail from the city station two miles away. Birmingham and the Midlands can be quickly reached by the M1 motorway.

Among the companies based at Luton airport are Hunting Aircraft, Helicopter Services, Napier (Flight Development), English Electric, and Luton Flying Club. Among the airlines operating scheduled services are BKS and Derby Airways.

ATLANTIC RUNNERS

NORTH Atlantic traffic figures for the first three months of 1960 confirm that BOAC have not been able to maintain the second place that they held in 1959 (*Flight*, June 24, page 879). The corporation's efforts on these routes—33 per cent more seats between the UK and the US during the first quarter of 1960 compared with the first quarter of 1959—were notable indeed, but were evidently not as great as the increases in output recorded by TWA, who offered 60 per cent more seats. In terms of seats filled, the US airline is again in second place after Pan American, having overtaken BOAC some time last November. TWA has subsequently forged strongly ahead.

During the first three months of 1960, BOAC's UK-US traffic (both ways) was 25,686 passengers—an increase of 12.5 per cent over the corresponding 1959 period despite the one-third increase in seats (load factor was 52 per cent). TWA's total was 31,507 passengers—an increase of 71 per cent. Thus TWA recorded a traffic growth-rate more than five times that of BOAC in the period concerned—a measure no doubt of the effect of the BOAC 707 delivery delays on the corporation's expansion plans. BOAC are still, in July, evidently being held back by a shortage of capacity: a load factor of 98 per cent was achieved last week on the corporation's routes to Canada and the US. (Altogether 7,933 seats were offered, 36 per cent more than last year.)

A previous note in these columns (June 10, page 808) recorded a big expansion of BOAC's transatlantic charter traffic—an average of two group charters per day being handled during this season. The number of BOAC charter passengers carried this year is expected to exceed the 12,000 believed to have been carried in 1959. Figures published by *Aviation Week* for other transatlantic airlines' charter traffic are listed as follows (last year's figures in parenthesis):

Air France, 35 flights (22); **Alitalia,** less than 5,775 passengers (5,775);* **Air-India,** not available; **BOAC,** 7,500 passengers (12,000); **Irish Airlines,** 10 flights (nil); **KLM,** not available; **Lufthansa,** at least 30 flights (15); **Pan-American,** 18,000-19,000 passengers (18,615); **Qantas,** nil; **Swissair,** not available; **Sabena,** 4,000 passengers (3,296); **SAS,** 150 flights (76); **TWA,** less than last year (102,097 passengers);† **TCA,** nil flights (33); **US Overseas Airlines,** 25 flights (10); **Capitol Airways,** 60-75 flights (30 plus).

*Reportedly decreased due to the loss of a DC-7C at Shannon, and DC-8 delivery dates which kept a DC-7C out of charter work.

†88 per cent of which was from MATS contracts.

Charter activity is greatly increased, but according to the US source this is viewed with some misgivings—mainly on the grounds of diversion from scheduled economy services.

Footnote: The CAB have relaxed somewhat their restrictions on Eagle's transatlantic charters. It will be recalled (*Flight*, June 3, page 771) that the CAB applied to Eagle the same rule as they apply to the charter activities of the scheduled North Atlantic carriers, namely that off-route charter mileage shall be limited to 10 per cent of scheduled mileage. This obviously would have limited Eagle's charters to a very few flights, since the scheduled mileage into the USA by Eagle Bahamas and Eagle Bermuda is only a fraction of the scheduled airlines' transatlantic flights. The CAB says that Eagle Bermuda, the company that made the application, can transfer some charter business to Eagle Bahamas, and that both can calculate their 10 per cent limitation on the basis of a twelve month projection of the highest calendar quarter of operations last year. The CAB said: "Nothing has been presented to us which would lead us to conclude that the carrier was not making charter plans wholly at its own risk and that they were made not in reliance upon any Board pronouncements but rather apparently in the face of them."

VISCOUNTS FOR AIR INTER?

HAVING sold three of its Viscount 708s to Maitland Drewery, Air France may now, it is reported, dispose of five more to Air Inter, an operator in which Air France has an interest. It was formed recently to operate domestic air services with aircraft chartered from Air France and other French carriers.

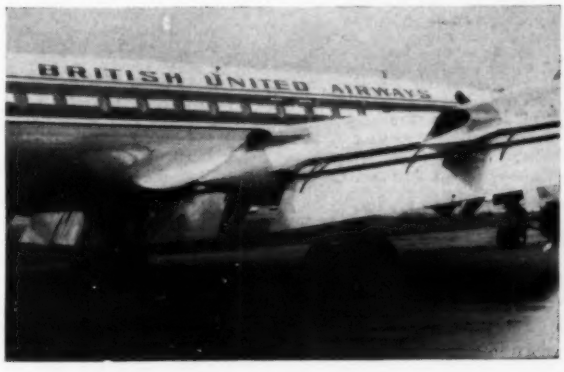
Air Inter's seasonal scheduled services (not necessarily Viscount) due to be operated this summer are as follows: Paris (Orly) - Lourdes, daily; Paris (Le Bourget) - Toulouse, daily; Paris (Orly) - Dinard - Quimper, twice weekly; Paris (Orly) - La Baule, once weekly; Paris (Orly) - Biarritz, twice weekly; Biarritz - Lourdes - Nice, once weekly. The capital of Air Inter was recently raised from NFr 4m to 5.5m (£291,000 to £400,000).

THE MINISTER WILL "DO HIS DAMNDEST"

SYMPATHY with those who would like to forbid all jet flying at night was expressed by Mr Sandys last week but, he said, "I am afraid it is just not practicable. There are not enough hours in the day to cope with all the traffic that wishes to come to London." This remark, the most flexible yet made by the Minister on the subject of night jet operations from London Airport, virtually gives aspiring night jet operators the "clear to go."

Other extracts from Mr Sandys' speech:

- "The airport employs about 30,000 people, and many of them have chosen to live in the neighbourhood so as to be handy to their jobs. . . .
- "About one quarter of the local residents have settled there since 1955. . . .
- "The value of house property has gone up in much the same way as other property elsewhere around London. . . .
- "Air travel is one of the blessings and aircraft noise is one of the curses of our modern age. I promise we will do our damndest to limit this nuisance in every practicable way. . . ."



Seen last week at Southend were these interim British United Airways markings on Britannia 307 G-ANCE of Air Charter

AIR COMMERCE . . .

THE BOARD'S BUSY YEAR

"Major Changes" in British Civil Aviation—Lord Brabazon

THE statistical summary at the end of the Air Registration Board's twenty-third annual report, published last week, tends to give a misleading impression of its activities in the year ended March 31. The summary shows that the issue of certificates of airworthiness for prototypes has dropped from six to two, modified prototypes from 25 to 16 and series aircraft from 227 to 139. It shows also that the number of licences issued to commercial pilots has been halved. Yet the year under review has been among the busiest in the Board's history.

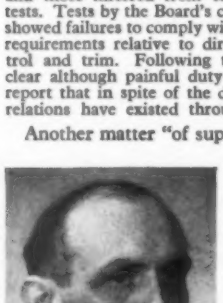
Introducing the report, Lord Brabazon, the ARB chairman, says that "major changes have swept through the broad field of British civil aviation," and although mergers have as yet had little direct effect on the Board's activities the ARB "would have to be prepared to modify its procedures to suit changing circumstances." Highlighting the activities of the past year, Lord Brabazon said that there had been an intensive national effort to bring legislation relating to the construction and operation of civil aircraft into line with current practices. The "Air Service Licence" which the Air Transport Licensing Board will issue to operators was also important because the MoA would seek advice from the ARB on an operator's engineering competence.

Mr R. E. Hardingham
chief executive and secretary

But to the man in the street the most significant single act by the ARB in the year 1959-60 was certification of the Boeing 707-420 after modifications not then made mandatory by the Federal Aviation Agency had been demanded of Boeing. Of this Lord Brabazon says:

"Application of the Board's flight test requirements has had two effects. Practical demonstration of take-off distances with the tail fully down revealed a discrepancy between the real minimum unstick speeds and those inferred from earlier free-air tests. Tests by the Board's chief test pilot showed failures to comply with the British requirements relative to directional control and trim. Following these tests, the Board concluded it had a clear although painful duty to require improvement. I am pleased to report that in spite of the difficulty of this situation, the most friendly relations have existed throughout between all parties."

Another matter "of supreme importance to the Board" was the Government decision to order military transports to the specification of their civil counterparts. It was of the utmost value, said the ARB's chairman, that this situation should be maintained. But he added, "I am a little dismayed at the extent to which additional requirements of non-military significance are superimposed on those of the Air Registration Board."



Mr Walter Tye
chief technical officer

Of the mergers affecting the industry Lord Brabazon notes that in the past much had been gained from the viewpoints of fairly numerous constructors, and he warned that "a narrowing of this variety could have its disadvantages." A change that did meet with his approval was in the provisions of the Air Navigation Order and Air Navigation Regulations. Much material that was hitherto in ANRs would now be found in BCARs and this legislation should become effective in its new form within the next few months.

Co-operation with ICAO

The sections of the report dealing with detailed activities of the Board during the year give precedence to the results of a meeting of the ICAO Airworthiness Committee, at which the ARB was represented, in Stockholm in July 1959. It was possible at the meeting to agree an international set of performance rules which, although differing in format, are technically largely in line with the latest BCAR. This, comments the ARB with satisfaction, is a major achievement and the result of long and sometimes acrimonious discussions over nearly 15 years.

Supersonic Aircraft

How should the Board tackle the airworthiness requirements of novel vehicles, not yet built? Their longer-term activities, they say, are necessarily restricted; but the airworthiness aspects of VTOL are being examined and the board's staff serves on the Aeronautical Research Council. A Supersonic Aeroplane Airworthiness Committee was set up by the ARB in March 1959. On it are represented constructors concerned with supersonic studies, BOAC and BEA, the MoA and the Meteorological Office. It has met "several times." This work has served, notes Lord Brabazon, "to emphasize the magnitude of the task of establishing sound airworthiness requirements for supersonic aircraft."

Other ARB committee work includes the examination of safety problems of landing and take-off aids and participation in the formation of a Transport Flight Safety Committee. The terms of reference of the latter are to consider common problems of safety; to agree systems for the collection, analysis and exchange of information; and to advise on safety publicity within the industry. "One of the best ways to prevent accidents is to learn as rapidly as possible from those that have happened."

Certificates of Airworthiness

Although the number of prototypes given a C of A during the year has decreased, the volume of work has increased. This is because initial discussions on the next generation of designs has overlapped investigations on current prototypes. In the air transport category the AW.650 Argosy now has a special-category C of A and discussions have been held on the Avro 748, VC 10, D.H.121, SC.5, SC.7 and SC.6—the last a hitherto unpublished designation for a projected Canberra U.10 replacement. (It is understood that design has now been discontinued.) Detail design of the S.C.7 "is now well advanced"; and the report adds, most significantly, that the "Board has had a number of preliminary discussions with other constructors interested in small aircraft."

From the ARB's point of view, this might almost be said to be a small aircraft year. Applications for the validation of foreign C of As during the last few months of the year numbered 40. A total of 53 were approved (23 last year), and a further 12 are still under investigation. Most of the aircraft "were of the lightweight and business variety." One of the major problems here has been that presentation of technical data for foreign business aircraft is extremely diverse and the Board is examining ways of overcoming the lack of appropriate flight manuals. "Foreign manufacturers," they say, "appear to find great difficulty in producing the data required in accordance with Air Navigation Regulations." Simpler performance rules are being prepared and these will be coupled with a much simplified flight manual presentation.

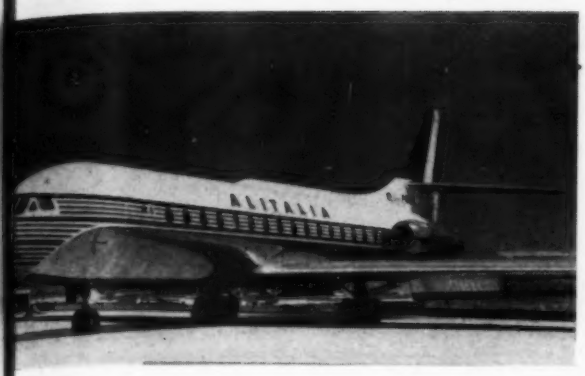
So much for imported aircraft. About export aircraft the Board say that "recent discussions with the MoA have shown that the Board's earnest proposals for the introduction of a C of A for export are feasible"—and in due course a UK Certificate of Airworthiness for Export will become a reality.

Legislation Changes

Older aircraft such as the DC-3 and Viking are others for which the ARB has been drafting legislation changes. Following the issue of revised Air Navigation Regulations on WAT limitations published some months ago, a further revision of the performance part of ANRs is now in hand. Some performance schedules have been prepared for amendment in anticipation of these revisions. Included is the issue of WAT-limit curves where these did not previously exist.

The interpretive material in the BCARs dealing with the performance requirements of aeroplanes has also been reissued, in particular the performance and handling requirements. These are a compromise between earlier UK and US views. By their issue, notes the report, "they have narrowed the gap in a field where, for many years, the two countries have been fundamentally at variance."

Finally, Lord Brabazon was able to say that by careful management the Board had been able to conclude the year without making a loss. Negotiations about the financial structure of the Board until 1970 had now been concluded with the MoA and the chairman said he hoped the ARB would be able to continue to be financially sound, adding: "This must be the keystone to the Board's technical integrity."



Until next year, when Alitalia's aircraft don the uniform of Air Union, they will continue to be seen in the stylish markings shown off so well by this Caravelle—one of eight on order. Scheduled services began on May 23 on the London - Rome route, followed by London - Milan on June 16. Cities served from Rome include Athens, Tel Aviv, Beirut, Damascus, Baghdad and Teheran

THREATS TO SAA

THREATS made at the recent Addis Ababa conference of the free African States to refuse landing rights and air space to South African Airways run counter to all international agreements. The only countries to break this rule in the post-war world have been some Iron Curtain countries—some of which, in any case, are not members of ICAO. Israel and the Arab States are still technically in a state of war, hence the Arab states' refusal of rights to El Al does not come in the same category.

The difficulties in implementing a ban on SAA have been recognized by Kenya's African Minister, Giakonyo Kiano, who told the African nationalist Tom Mboya in the colony's legislature recently that while he sympathized with the sentiments of banning SAA there were international obligations to be met. He pointed out, amid laughter, that he himself and Mr Mboya were regular users of South African Airways—although they had subscribed to the Accra proposal to boycott South African goods.

While there has not been any official reaction from South Africa, the Government's attitude has been that it is one thing to talk about boycotts, but another to implement them. SAA has always denied that its decision to buy Boeing 707-320s (the first was due to be delivered last Tuesday, July 12) was influenced by the need to have an aircraft that can fly non-stop from Johannesburg to Europe should hostile black States refuse rights. But aviation circles feel this argument has some weight when the Cabinet decided to buy 707s, which will be extremely difficult to fill.

If SAA want to fly non-stop to Europe, Jan Smuts Airport (10,500ft, elev. 5,559ft) will have to be lengthened by up to 5,000ft to enable a full-capacity take-off. Durban might be suitable at times, though mostly temperatures would be too high there for a full-capacity take-off. But once the 707s are airborne, the problem of alternate airports on the long haul to Europe in the event of an emergency arises. The only alternates are in a hostile black Africa. The Addis Ababa resolution goes further than the refusal of ground facilities. It also talks of a ban on first freedom rights to use air space—which could lead to an SAA machine being forced or shot down if SAA decided to ignore the ban.

There are already signs of black sanctions on SAA. It is reported in the Johannesburg *Sunday Times* that SAA will cease to use Kano as a refuelling stop as from October 1, the date of Nigeria's independence. It is said that Nigeria has indicated that SAA services will not be acceptable. The report also states that Sudan may in future refuse SAA crew stopover facilities at Khartoum. A spokesman for SAA said last week that the 707s have sufficient range not to make a refuelling stop at Kano. The Nigerian authorities had been informed of this "some months ago," the spokesman said. An earlier SAA statement suggested that in any case Kano's runway was not long enough for the 707.

BREVITIES

The chairman of Ethiopian Airlines, which is managed by TWA, has stated that the airline is to purchase jets to replace its DC-6Bs.

London Airport's commandant, Mr James Jeffs, is to retire at the end of September. He is to become an aviation consultant.

BEA's chief maintenance engineer, Mr Ivor Gregory, has been installed as president of the Society of Licensed Aircraft Engineers for 1960/62. Vice-president is to be Mr Stanley Davis of Airwork Services.

We regret to announce the death in Brisbane recently of Capt R. F. Adair, OBE, founder and managing director of Queensland Airlines. He was 64.

Just published is *Survey of Research Projects in the Field of Aviation Safety* by the Daniel & Florence Guggenheim Aviation Safety Center at Cornell University. UK inquiries should be addressed to Bosko B. Stanojlovic, 127 Pepys Road, London SE14.

BEA'S frequency out of London Airport is now at the rate of 100 scheduled departures every day of the week, the highest on record. The busiest period is between 0800hr and 1100hr when 28 Viscounts and Comet 4Bs depart with about 1,600 passengers.

Overseas Aviation have applied to the ATAC for a licence to operate a UK internal service between London (Gatwick), Manchester and Glasgow. It would be on a daily basis operated with Vikings and Argonauts.

After what Swissair call "protracted negotiations" the airline has obtained the Argentine government's permission to extend its second weekly South American flight to Buenos Aires from the end of July. So far this flight has terminated in Sao Paulo while the other has continued to Buenos Aires *via* Montevideo.

A DC-3 operated by Lineas Aereas Costarricenses, TI-1023, crashed on a flight from San José to Los Chiles de Grecia on June 27. One passenger was killed and 12 others were injured. The pilot, Don Carlos Holst, was seriously hurt. This was the twenty-fourth fatal airline accident during the first six months of 1960, and the twelfth involving a Latin-American airline.

The maiden flight of the prototype Breguet 941 STOL transport is scheduled for the spring of 1961.

The ARB announces the issue of Notice to licensed aircraft engineers and to owners of civil aircraft No 4, Issue 2, July 1. It concerns propellers approved for use on civil aircraft.

All of Sabena's transatlantic flights were suspended last week so that the airline's entire fleet was available for evacuation of Belgians from the Congo.

The American FAA awarded the Boeing 720 its airworthiness certificate on June 30, five months after the first flight on January 8. Total number of hours flown on certification tests was 4,420 in 148 FAA flights.

According to Mr Seijiro Yanagita, president of Japan Air Lines and the 1960 president of IATA, Aeroflot has been formally invited to join IATA. Mr Yanagita said that the invitation had not been accepted. This is the first indication that IATA wishes Aeroflot to become a member.

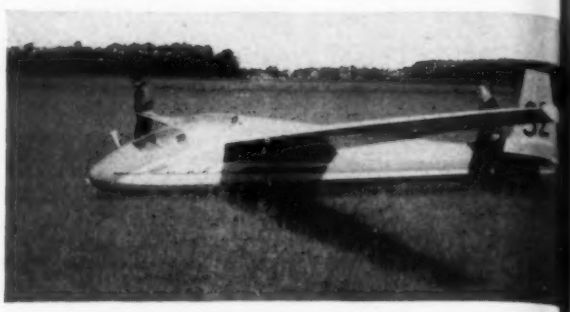
It is reported that Pan American are to purchase three more Boeing 707-320s for delivery early in 1961. The total number of Boeing 707s the airline has on order at present is 29, of which six are 707-120s and 23 are 707-320s. The total number of Boeing jet airliners now ordered is 220, of which 125 are in service.

The private Argentinian airline Aerolineas Ini y Cia has become a member of IATA. It operates between Buenos Aires, Santiago, Lima, Guayaquil, Panama and Miami with DC-4s and, in the near future, DC-6s. President is José Ini. With the amalgamation of Airwork and Hunting Clan into British United Airways the total membership of IATA now stands at 89.

The Minister of Aviation was asked in the Commons last week whether, to alleviate jet noise on the approach at London Airport, it was not possible to increase the angle of glide path. Would he, Mr A. Royle (Con, Richmond, Surrey) asked, initiate international negotiations "to raise the angle of glide paths above all airfields in the United Kingdom from 3° to 4° or 5°?" Mr Sandys considered that this would prejudice safety.

Because of the ban on jet flying at Fornebu Airport, Oslo, BEA Comet 4Bs are using Gordermoen, 25 miles from the capital (Fornebu is six miles away). It is understood that BEA's Scandinavian services are to be amended in the autumn, and the London - Oslo route will revert from Comet 4B to Viscount operations. On October 2, the London - Stockholm daily Comet service will be routed *via* Copenhagen instead of Oslo, and Viscounts will operate direct to Oslo Fornebu.

Leaving TEAL at the end of the month are (left) George Bolt, chief engineer, since 1944; and John Veale, assistant general manager since 1947. Mr Bolt retires and Mr Veale becomes general manager of a new business in Auckland



The fourth International Swiss Watch Air Rally at Bienne earlier this month was won by Dr Joseph McClory of Newcastle-upon-Tyne, here seen (right) receiving his first-prize watch from Dr Dominique Weibel, president of Bienne Aero Club. A member of the rally committee, John Jenoure, is on the left. Dr McClory was flying a Prentice. The ladies' prize was won by Miss Peggy Simpson of Harrow, flying an Autocrat. Above right is the Polish Mucha Standart flown in the recent World Gliding Championships by Xhaet of Belgium. BGA evaluation of this type is reported below

Sport and Business

RECENTLY EVALUATED at Cambridge Airport by No 2 Test Group of the British Gliding Association is a Polish SZD 22B Mucha Standart sailplane. Series production of this aircraft (the prototype of which, flown by Adam Witek, won the Standard Class of the 1958 World Gliding Championships) has now begun, and the selling price in this country is expected to be £1,170 including import duty and basic instruments. The agents for Polish gliders in this country are Norco Engineering Ltd, Burgess Hill, Sussex. One of the Cambridge pilots, David Carrow, hopes to fly the demonstration Mucha Standart in the forthcoming national soaring week at Dunstable. The other pilots involved in the evaluation of the Mucha were Dr John Pringle (president of the Cambridge University Gliding Club), Lionel Alexander and Colin Pennycuick.

FOR THE SECOND YEAR in succession, the Armstrong Whitworth Flying Group have won the Popular Flying Association's Masefield Trophy for the member-club showing the best all-round efficiency. The group operates Tiger Moth G-ALWW, known as Weary Willie, at Baginton Airport, Coventry.

THE FIRST COURSE to be organized by the recently formed Scottish Parachute Club was marred last month by the fatal accident to pupil K. Mostyn during a descent on the third day of the meeting. From observation of his flight and later examination of his equipment, the club reports, there seems little doubt that the cause of the accident was that the ripcord was pulled too late. After the accident one pupil declined to continue but the remainder recommenced their programme of drops as soon as the weather made this possible. The course was completed without further incident or injury.

In the two-week period jumping was possible on only nine days, in which time 115 descents were made. The instructors were Sgts P. Denley and K. J. Teesdale of No 1 Parachute Training School, RAF Abingdon, with T. Blyth and A. Anderson of Airwork acting as pilots, overall facilities being provided by the Perth aerodrome manager, Wg Cdr F. D. Nugent. Most of the descents were made from a Rapide, although each of the fourteen pupils made at least one jump from an Auster in addition. Towards the end of the course it was found possible to despatch sticks of four parachutists.

THE POSSIBLE FORMATION of a National Flying Trust for the promotion of gliding and light-aircraft flying was the subject of a question in the House of Commons on July 4. Sir Wavell Wakefield asked the Minister of Aviation what progress had been made with the formation of such a Trust. Mr Duncan Sandys replied "I am pursuing this idea, but am not yet ready to make a statement." The Minister agreed that the development of a Trust was an urgent necessity, adding: "The disappearance of the Kemsley Flying Trust has created a gap, and I am seeing what can be done to fill it."

In another question, Richard Collard asked the Minister if he would set aside a small section of his department to deal specially with private and club flying. Mr Sandys replied that there was already in existence a branch which "deals with most of the main aspects of private and club flying." Mr Collard suggested that it would be a great encouragement to private and civil flying, "which is regarded as rather a poor relation" if there were "a clearly defined section to which they could take their troubles."

First British student pilot to solo one of Maitland Drewery's Champion Tri-Travelers at Biggin Hill was Donald Campbell, seen here (right) with company chairman Edward Drewery and Tri-Traveler G-APYU. Mr Campbell is now the owner of a new Piper Comanche, G-ARBO

RETROSPECT

From "Flight" of July 16, 1910

Flying from the Crystal Palace: After his flights at the Crystal Palace last week, Mr. Claude Grahame-White announced his determination to fly to Bournemouth, and arranged to start on Thursday afternoon. At the first attempt the engine misfired a good deal, but later this was remedied, and Mr. White took his seat on the machine and got off successfully. He cleared the trees round the enclosure, but within a few seconds Mr. White was in trouble, and was forced to bring his machine down at Norwood. On making a sudden turn to avoid some trees, the machine landed rather violently, resulting in the propeller being smashed. It was then decided to dismantle the machine and send it on to Bournemouth by train.

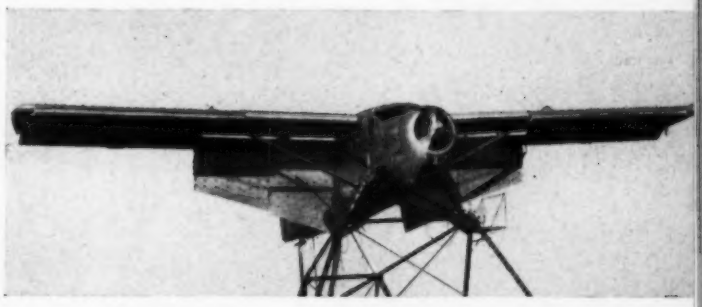
THE BIGGEST AIR RALLY ever staged in Central Africa attracted thousands of spectators to Mount Hampden Airport, 14 miles outside Salisbury, S. Rhodesia, on Sunday, June 19. The display, with more than 40 aircraft on parade, was staged jointly by three clubs—Mashonaland Flying Club, Central African Parachuting Club and Salisbury Glider Club. Observers flew in from a number of clubs outside Rhodesia. Among the aircraft were Piper Cubs, Tri-Pacers, Chipmunks, Bonanzas, Tiger Moths, a Comanche, Auster and Hiller 12E helicopter, and the meeting was attended by the Director of Civil Aviation, Col Maurice Barber. The real significance of the occasion was that it formed a "test run" for more-ambitious programmes in future years. The 1961 display, for instance, is to include a number of competitive events, and more visiting clubs will be invited.

THE FIRST SCINTEX CP-301C EMERAUDE to be purchased by a private person in the United Kingdom was collected at Toussus-le-Noble on July 2 by Francis Couesnon, UK representative of the Scintex company. The type is now available on two-month delivery in this country at a duty-paid price of £2,392.

A SECOND PIAGGIO P.166 has been delivered to Port Moresby for Papuan Air Transport Patair, who began operations with their first P.166 in New Guinea some nine months ago. Another P.166, again the second of its type for this customer, has been ordered by AGIP Mineraria, the Italian oil prospecting company, for the transport of company personnel in Iran and Morocco.

A THIRD HANDBOOK has been produced by W. S. Shackleton Ltd for the guidance of potential customers. Entitled *Your Own Aircraft*, this describes the advantages to be obtained from the use of a company-operated executive aircraft, but differs from the two previous publications in not giving details of particular types.

Full-scale results were obtained by towing the Otter on wheeled pylon structures. Note the area of the double-slotted flaps



STOL Otter

SINCE 1956 the de Havilland Aircraft Co of Canada has, with the help of the Canadian Defence Research Board, investigated some of the problems of STOL (short take-off and landing) aircraft. From the outset it was decided to adhere to the conventional fixed-wing and propeller formula, and it was early appreciated that the DHC.3 Otter was an excellent basis for a STOL modification. Not only was it a proven vehicle, but it seemed clear that excellent results would be forthcoming from a machine of simple conception which would show marked economic advantages over all VTOL devices.

Studies showed that it was possible to employ propeller slipstream as a source of high-pressure air for boundary-layer control. Direct effect of slipstream was to pass high-velocity air over the flaps, generating lift and drag even at zero forward speed. Indirect effect was to spread slipstream spanwise and thus cause high-velocity air to flow through the flap slots over a considerable portion of the span.

Rig tests revealed that rough flow over the flaps gave rise to unstable flow round the tail and reduced lift. Flexible extensions were added to the rear of the fixed part of the wing, to direct slot flow down over the flaps, and the inboard part of each flap was arranged to be depressed to a large angle to provide the drag needed for landing. Thus a system offering adequate lift, drag and stability was achieved after only 11 test runs. A further 24 runs gave the required coefficients needed for the flight vehicle. Analysis of aileron and rudder effectiveness indicated that some form of BLC (boundary-layer control) would be needed, and a model mounted on a truck driven at various speeds sufficed to give the information necessary. Control investigation on the actual aircraft indicated that additional tailplane power would be required. A tailplane of revised section was fitted, with vortex generators to increase elevator effectiveness. This was found to be inadequate, and an entirely new tailplane, using Caribou data, was designed and accepted without further testing (it appears to have an upside-down section and reversed slot ahead of the elevator). With flaps down rudder buffet was experienced, and, while it was cured with a modified rudder used for BLC experiments, the effectiveness of the blown rudder was found to be severely dependent on elevator angle. Accordingly the tailplane was mounted at a lower point on the fin and the desired increase in height achieved by dihedral. Standard Otter ailerons were investigated and replaced by BLC surfaces.

In all this work an IBM computer proved of great advantage; but the sheer magnitude of the research effort made it prudent to carry out flow-visualization tests. A smoke producer was devised, discharging through a 3in hose. This at once confirmed the BLC effect of slipstream over the flaps, showed how misleading tufts can be in many instances, demonstrated the strength and location of trailing vortices and showed that the ailerons were close to a disturbed region and that the huge flap lifts caused a strong upflow and separation at the leading edge. The smoke also rendered visible the strong downwash even close to the ground, minimizing ground effect and allowing manual elevators.

While testing of models, full-scale rigs, towed low and high trestles and tunnel runs all helped to gather the data needed, the actual aircraft was built and flown. At first it was held at low altitudes along the Downsview runway, but by March of this year it was regularly airborne at several thousand feet for over an hour at a time. Already "very interesting" information on the dynamic stability and control parameters has been obtained and work is currently in hand on lift, drag and static stability. Dynamic characteristics will also be measured; and the STOL Otter has already demonstrated outstanding stability.

Very few data have so far been divulged, but in a paper submitted to the Canadian Aeronautical Institute, Dr D. H. Henshaw, of D. H. Canada, states that with 60° flap (full design deflection is 90°) the aircraft can fly comfortably at 35kt. Based on the large area, the C_L is 4 at this speed. Landing, at 7,500lb in zero wind, takes under 500ft from 50ft, with a ground roll of less than 200ft. Future testing, with greater flap angles and drooped ailerons, will yield even better values.

The four-wheel undercarriage was adopted in order to maintain good airflow over the tail even when the aircraft is on the ground

MASEFIELD CHIPMUNK (*Continued from page* 98)

a position error of −1kt into account this seems to agree quite well with the 118kt at 1,000ft and 120kt at 2,000ft true airspeed recorded by Mr Masefield over a measured course.

The Chipmunk gives very little indication that it is flying at a speed greater than its designed level maximum. At these speeds, the coarse-pitch propeller limits r.p.m. to 2,320 and noise and vibration level are slightly lower than on the standard model. Close fitting of the canopy and careful sealing of the cockpit is partly responsible, and draught exclusion must certainly add to the comfort of flying an unheated aeroplane.

A joy of this essentially touring conversion is that, provided it is kept within weight limits, the Chipmunk remains fully aerobatic; to my pleasure I found that it can be looped without difficulty from straight and level cruise without losing height, and the crisp ailerons and well-harmonized controls of the standard aircraft remain unimpaired. The normal 120kt for a loop comes up in a very short dive and there is no danger of building up excessive r.p.m. From a high-altitude cruise, full throttle, high-speed descents are a normal time-saver. I liked the aerobatics so much that I spent some enjoyable minutes forgetful of my intention to compare the handling of this Chipmunk with a standard one; but I was sharply reminded of Tango Mike's essentially executive nature in a rather slow roll which brought a veritable shower of maps and paper down on to the roof. I was nearly spiked by the two famous "house" flags.

At the owner's suggestion and with respect to increased weight I made the first approach 5kt faster than is normal for the standard aircraft. But while at 650ft/min the heavier Chipmunk indicated a rate of descent 50 per cent greater at 65kt power-off than the standard version, the elevator remains effective in checking descent very nearly down to the stall, and I decided after the first attempt that a 60kt approach resulted in a more reasonable arrival speed. A flash of the Masefield slide-rule confirmed this as 1.3 V_{SL}.

There are no limitations on sideslipping the modified Chipmunk, but here I noticed one of the few aerodynamic effects of the modifications other than higher speed. I could just detect in a sideslip the increased area forward of the c.g. provided by the modified exhaust manifold. A bigger bootful of rudder was needed than in the standard aircraft, but adequate control was available and the Chipmunk slipped with the stick neutral.

After one or two landings on grass I returned to Gatwick for a landing in a 12kt wind 90° across the runway. If any control deficiencies were there, I thought, this is where they would show up. But the Chipmunk wheeled on smoothly and was quite easy to hold although some weathercocking developed towards the end of the landing run, possibly due to fading of the shrouded brake.

The Masefield modifications are undoubtedly successful. Starting on a silk-purse trainer, the conversion has made the Chipmunk —if not more comfortable—much more practical for touring. Aerodynamic differences are barely detectable except on the a.s.i. and the modified aircraft remains just as easy to fly. Similar conversions, including many of the features described, are now obtainable at a cost of about £600. An alteration not yet incorporated on the Masefield Chipmunk is two additional fuel tanks in the leading edge giving an endurance of more than five hours.

Mr Masefield's next idea, now under discussion with Tiltman Langley, is to sheathe the complete wing in ultra-thin gauge light alloy sheet to see what effect can be gained by cleaning up the surface. Another one is to fit a Hartzell or McCauley constant-speed propeller. The ultimate target is 130kt in level flight. By any standards that is a really useful piece of light-aircraft research.

Princess Margaret walking to a graduation and dedication service at St Nicholas' Church, Thorney Island, during her July 6 visit to No 2 ANS (this page, last week). Accompanying Her Royal Highness are the station commander, Gp Capt W. G. Devas, and the Air Minister, Mr George Ward

SERVICE AVIATION

Air Force, Naval and Army Flying News

Valiant's Double Record

ANOTHER unofficial record, for the return journey from Vancouver to the UK, was set up last Friday by the Vickers Valiant of Bomber Command which on July 5 made the 5,007-mile westward flight in 10hr 28min. Its elapsed time from take-off from Vancouver to landing at Marham was 9hr 35min, giving an average speed of 523 m.p.h. On both flights it was refuelled by another Valiant from the same squadron (No 214) over Goose Bay, Labrador. The aircraft captain was AVM M. H. Dwyer, AOC No 3 Group, with Sqn Ldr B. E. Fern as co-pilot. The tanker Valiant was captained by Flt Lt A. W. McDonald. No 214 Sqn is based at Marham.

Comet Operations

SOME aspects of No 216 Sqn operations were discussed by Sqn Ldr P. E. Pullan in an article called *Three Years with Comets*, published recently by *Air Clues*. On ATC procedures, he says that crews often have the advantage of a choice: when going into Changi, for example, "they can either let down on a cruise descent through the Singapore airways system, fitting in with the airliners using the civil airport, or they can perform a high-level QGH at Changi. The Comets possess both the ten-channel TR1998 VHF for the military frequencies and the 140-channel STR 12D which covers the whole civil band."

Going into Kai-Tak, Hong Kong, "with its peculiarities of terrain, special types of let-down and dangers of bad weather, requires specialised local knowledge. Captains may land there only if they have had previous experience. Any pilot going into Hong Kong for the first time picks up one of the captains of the FEAF Hastings at Singapore."

On the problem of weather, Sqn Ldr Pullan says that the squadron soon discovered that in equatorial latitudes at a cruising altitude of between 35,000ft and 40,000ft, not only did cumulo-nimbus clouds often tower above them but they flew for long periods enveloped in cirrus—with the danger of unwittingly entering a thunderstorm. This happened occasionally in the early days, with frightening results, vertical gusts once causing two of the engines to flame out. New engine handling and flying techniques have been evolved for severe turbulence, but the best method for avoiding such hazards is radar: "if the weather gets really bad, as sometimes happens in the Intertropical Convergence Zone, with big build-ups of cloud all round and no apparent way through, Iso-Echo may be used. This allows the cores of storms to be identified so that aircraft can weave an unpleasant, but safe, passage through them."

Calypso Stream III

THREE Avro Shackletons of No 204 Sqn, Coastal Command, are making a 10,000-mile goodwill visit — Operation "Calypso Stream III"—to the Caribbean area: this began last Monday and continues until July 28; the itinerary includes Bermuda, Jamaica, British Honduras and Trinidad, and low-level flypasts are being made over some of the smaller territories, including Barbados and the Windward and Leeward Islands. The Shackletons are taking with them on their flight from Ballykelly a mobile RAF exhibition which is being shown in Belize during the visit to British Honduras. The force commander is Gp Capt J. R. Armitstead, who is OC Ballykelly; and the CO of No 204 Sqn is Wg Cdr J. C. W. Weller.

Airborne Broadcasting

IN Malaya recently the 10,000th broadcast was made by the "Voice Flight"—currently operated by No 52 Sqn—of the Far East Air Force. The flight, based on Penang island and commanded by Flt Lt H. Haines, uses two Dakotas fitted with special equipment: four loudspeakers are carried under the belly of the aircraft at an angle of 45° to port; loudspeaker range is 2,500yd and broadcasts are made from a height of 2,500ft, the crew flying a modified square-search on a left-hand circuit. This technique of psychological warfare has been used against Communist terrorists (remnants of whom are still hidden deep in the Malayan jungle) for the past six years, previous "operators" having been Nos 267 and 209 Sqns.

Reserves Club President

AT the RAF Reserves Club on Wednesday last week Sir Miles Thomas was inducted as president in succession to the late Sir Archibald McIndoe: a case—as the chairman, Mr Ralph Attwell, pointed out—of one "very exceptional man" being succeeded by another. Mr Attwell paid a graceful tribute to the memory of Sir Archibald (a photograph of whom now hangs on a wall of the club lounge) and referred to the energetic personality and distinguished career of the new president—as RFC and RAF pilot, chairman of BOAC (1949-56) and industrialist.

Sir Miles, who was wearing an RFC tie (one more proof of the sartorial distinction with which he has lately been credited), acknowledged the honour he felt in accepting the chairmanship of "so lively a club"; and as his first act invited his predecessor's widow, who was present, to become an honorary life member—a gesture which Lady McIndoe gracefully accepted.

IN BRIEF

AVM Keith L. B. Hodson, RCAF, who lost his life in a T-33 accident near Colorado Springs on July 5, had been Deputy Chief of Staff at North American Air Defence Command (NORAD) headquarters since 1958.

Crests of the aircraft carrier *Victorious* were presented in Moscow on June 30 to Russian seamen who last September rescued the crew of a Skyraider of 849B Flight from the North Sea.

Flt Lt T. L. Thompson of No 228 Sqn has been awarded a Queen's Commendation for Valuable Service in the Air for his helicopter rescue of the injured skipper of a trawler in the North Sea.

No 300 Sqn, Indian Navy, was commissioned at RNAS Brawdy on Thursday last week. This unit, the first combatant fighter squadron to be commissioned by the Indian Navy, is equipped with AWA Sea Hawks and commanded by Lt Cdr B. D. Law, RIN.

Chipmunks of Hull UAS framed in the fins of a Beverley after a formation take-off from Brough during a visit to the airfield by Granada TV. Below the Beverley's starboard wing is the B.2 (last survivor of the type once used for RAF Reserve training at Brough) and inside the Beverley fuselage is a dance band

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

American Sailplanes

YOUR magazine's articles concerning various gliding and soaring events are greatly appreciated. The available news sources that include even token coverage of such events in your country and on the European continent are few. Consequently, we hesitate to "bite the hand that feeds us." However, there is one item in *Prospects for Butzweiler* in your June 3 issue that requires clarification. You refer to the sailplane flown by Richard H. Johnson as the "RHJ-6." This aircraft is called the "Adastra" by Mr Johnson. You have possibly been confused by the name of the RJ-5 and assumed the Adastra to be a continuation of a family of sailplanes.

It appears that many are unaware that the "R" in the name RJ-5 is for Ross, the designer and builder of that sailplane and its four predecessors. Mr Harland Ross has designed and built several sailplanes which established US national or world records in their day. Included among those are the "Silver King," the "Zanonia" and the "Ibis." While it is true that Mr Johnson, under the tutelage of the late Dr August Raspet at Mississippi State University, improved the performance of the RJ-5 by geometric boundary layer control, it should not be forgotten the sailplane was, in its designed state, one of the highest performance sailplanes then in existence. Mr Ross' contribution to the success of that sailplane is, unfortunately and unjustly, usually omitted.

You might also be interested to know that the successor to the RJ-5 is the R-6. The wing of the R-6 is identical to the RJ-5 while the fuselage provides for two occupants. While flying the R-6 in the two-place configuration Mr Ross established world speed records for the 100, 200 and 300km triangles on three successive days—August 12 to 14, 1958—at Odessa, Texas. On August 15 that year he also established the two-place US national goal and return record of 234 miles. In the R-6 Mr Ross also completed US Diamond C No 14 last year with a 365-mile flight during which he attained an altitude of 21,800ft in a cu-nim. His average speed on this flight was in excess of 65 m.p.h.

One final item concerns the sailplane flown by Mr Richard Schreder. While he intended to take his HP-9 it is our understanding he actually took the HP-8. Perhaps your future issues will show the names of the two ships actually flown by the US team in the Open class.

We shall look forward to future issues for additional information on the World's sailplanes as well as subsequent notes on soaring.

Wichita 7, Kansas — H. MARSHALL CLAYBOURN, President, Kansas Soaring Association

[The June 3 list was as given by the organizers of the championships, and was subsequently corrected in our reports from Butzweiler. Schreder did fly the HP-8, but Johnson retained RHJ-6 as the designation of his aircraft in discussions with *Flight* at Butzweiler.—Ed.]

Link Training Value

FOR the benefit of those who, like myself, love flying and endeavour to attend as many International Rallies as possible during the short summer months, I would like to tell of my experience when returning from La Baule to Denham, via Cherbourg and Eastleigh, on June 27.

The day in La Baule was glorious with blue skies and sunshine. The weather reports obtained by the Royal Aero Club on the other hand were not quite so promising. These spoke of a general cloud base of 1,800-2,000ft, low stratus on the Cherbourg Peninsula and a general visibility of 5-8 miles. The weather prophets also promised an improvement towards midday. I therefore decided to set course in my Gemini G-AKEM, accompanied by my wife who acts as navigator.

At first weather was fair and visibility according to the forecast. On nearing Affranche, however, visibility got steadily worse and even at 1,000ft I was flying in and out of low stratus. I obviously could not go below 1,000ft as there is quite a bit of high ground on the Cherbourg Peninsula and I therefore carried on in the hope that: (1) It would not get worse; (2) I would certainly recognise the coast of the northernmost tip of the Cherbourg Peninsula; (3) I also had a radio which would enable me to home on Cherbourg by means of QDMs.

Visibility did not get worse, but on arriving at the coastline I found it difficult to find Cherbourg and had to make use of radio and QDMs to make a satisfactory landing.

The weather in Cherbourg was cold and unfriendly, low stratus kept drifting in from the sea and only occasionally could one catch a glimpse of a bit of blue sky. Having completed all the formalities I consulted Control and the weather man, who obtained an actual from Eastleigh which gave visibility at 3 n.m. Consulting Silver City pilots I was told that the top of the stratus was at about 2,000-2,500ft and that visibility on top was reasonable. I therefore arranged with Cherbourg Control to fly inland, climbing to 3,000ft; and if I had reached top and was satisfied with the conditions I found that I should set course for Eastleigh, checking my bearings with the Cherbourg homer. If, on the other hand, conditions were unsatisfactory I was to come down and Cherbourg would bring me in by means of QDMs.

Climbing to 3,000ft I found conditions far better than I had expected. I was well on top and having received my bearing from Cherbourg I set course. At 50° latitude the low stratus ended and was replaced by haze and mist which gave no forward and practically no downward visibility.

I then contacted Eastleigh homer and asked for weather conditions and QDMs. Eastleigh informed me that visibility had deteriorated, but that they would continue to give me QDMs. The ensuing half-hour was tense; I had never flown in such bad conditions before and when Eastleigh instructed me to fly to 4,000ft and maintain the course they had given me because they were bringing in two Dakotas, I did not feel particularly happy.

I listened to the two Dakotas being brought in and with great relief finally heard the Controller calling me and asking me to transmit for identification. From then on my troubles seemed to cease. I could not see, but the voice of the Eastleigh controller telling me what course to steer and what heights to maintain seemed to remove the responsibility from me to somebody else. I just concentrated on the instruments and went through the GCA procedure without any qualms or misgivings and eventually the controller stated GCA ended, land straight ahead. I looked up and there was the Eastleigh runway in front of me.

I must add that my rate of climb indicator chose to go unserviceable during this procedure and that the controller, apart from giving me course to steer, also always gave me the height I should be at at any given moment, with which I coped satisfactorily.

The moral of the whole story is that I would never have been able to complete this flight satisfactorily had I not taken a course of Link training instruction during the winter and kept up exercises once every fortnight. I concentrated particularly on GCAs because I felt that was probably the most likely exercise I might need one day.

Fellow private pilots, please note. Link training is not just a sport, but a necessity and an exercise that I recommend most warmly to everyone who wishes to go farther afield in the same way as I hope to for many more years. Just for general information I would add that I am 63 years of age.

London W6 — A. R. DRIESSEN

RNAS Airship Speeds

IN your issue of June 10 your contributor Mr Golightly, in his article on the RNAS airship, gives a maximum speed for the Zero type airship as 75 m.p.h. This figure needs correction. The Admiralty handbook for this type gave the maximum speed as 53 m.p.h. To obtain 75 m.p.h. a power unit of about 250 h.p. would have been required. The actual power of the Rolls-Royce Hawk used was 75.

Anyway, at 75 m.p.h. the nose of a non-rigid, with the gas pressure as used, would blow in (although, of course, bow stiffeners were fitted). I suppose 75 m.p.h. would be about the top speed of the later rigid types of ship. The figure 53 m.p.h. would seem to be quite high for such a small power unit as 75 with a thrust of, say, 450lb.

London SW12 — J. R. PIKE

FORTHCOMING EVENTS

July 16. Parachuting Competition, Woburn Abbey.
July 16-22. RAF Inter-Command Gliding Championships, Odiham.
July 17. Royal Aero Club Rally, Woburn Abbey.
July 20. Kronfeld Club: Film Evening.
July 23. RN Air Station Lossiemouth At Home.
July 23. Army Air Corps: Open Day, Middle Wallop, Stockbridge, Hants.
July 23-24. Trento Aero Club: 10th Aerial Circuit of the Dolomites.
July 23-31. Inter-Services Gliding Championships, Odiham.
July 24-Aug. 1. Gliding Weeks: Yorkshire GC., Sutton Bank; London GC., Dunstable; Coventry GC., Edge Hill (opens July 23).
July 27. Kronfeld Club: "132 Miles in a Cadet," by John Jeffries.
July 31-Aug. 7. Bulgarian Aero Club: World Parachuting Championships, Mousatchevo, near Sofia.
Aug. 3. Kronfeld Club: Polish film of 1958 World Gliding Championships.
Aug. 10. Kronfeld Club: MTCA Air-miss film.
Aug. 14. Elstree Flying Club: Tea Patrol.
Aug. 17. Kronfeld Club: Talk on National Gliding Week.
Aug. 20-21. Pescara Aero Club Rally.
Aug. 28. Oxford Aeroplane Club At Home, Kidlington.
Aug. 28-Sept. 4. Czech Aero Club: World Aerobatic Championships.
Sept. 3-5. French and Savoy Aero Clubs: International Centenary Rally, Aix-les-Bains.

THE INDUSTRY

Firth Cleveland Progress

IN his statement to shareholders of Firth Cleveland Ltd, issued in advance of the a.g.m. on July 20, Mr C. W. Hayward (chairman) reviews the work of the various companies that now form the group. Among those connected with the aviation industry are Simmonds Aerocessories, Firth Cleveland Instruments, Solartron Electronic Group and J. J. Habershon & Sons.

Points of interest from the report, concerning each of these four units, include: *Simmonds Aerocessories:* Orders increased by 57 per cent over 1958, the new South Wales factory is in full production, and hydrant fuel dispenser vehicles (manufactured under licence from the US Pryor Mfg Co) are expected to be increasingly used on Service and civil airfields. *Firth Cleveland Instruments* continue to supply contents gauges and electronic flowmeters for aircraft, marine and industrial applications, and new products are under development. *Solartron:* When the extension to the works at Farnborough, Hants, is completed at the end of the year the Solartron Group's UK factory space will exceed 250,000 sq ft. New all-electronic versions of the Solartron radar-training simulator have been sold at home and abroad, and the latest models of the precision analogue computer are in use in the aircraft and missile industry. *J. J. Habershon:* Output includes high-quality steel for the aircraft and other industries. The company's Sendzimir planetary mill for the hot rolling of stainless, high-carbon and mild-steel strip (one of the only five in the world) is capable of economically producing material of an exceptionally high quality, both dimensionally and in respect of surface finish.

Improved Dry Bearings

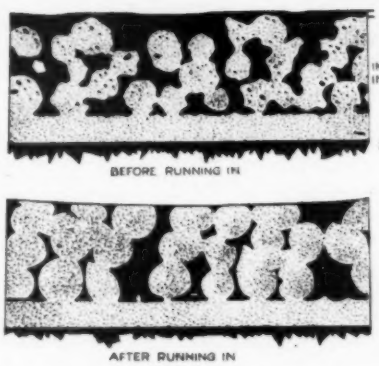
IN every modern aeroplane, and in nearly all guided weapons, there are many points at which there must be a bearing capable of carrying appreciable loads. It is naturally desirable to employ bearings requiring neither lubrication nor maintenance, but in the past this has usually entailed considerable compromise. In general, what has been needed is a true oil-free bearing material capable of withstanding considerable bearing pressure over a useful range of temperature and suffering from none of the many drawbacks which could render such a material almost valueless.

During the past few years the Glacier Metal Co Ltd, of Alperton, Middlesex, have progressively evolved what appears to be easily the best dry bearing material yet discovered. Essentially it comprises: a steel backing to provide structural strength; an interlayer, about 0.01in thick, formed from a pair of interlocked networks sintered from spheroidal bronze powder and impregnated throughout with a mixture of PTFE and lead; and an overlay of the PTFE/lead mixture, with a thickness of about 0.0008in, which rapidly deposits itself uniformly on the mating surface.

During the first few dozen hours of running the transfer of overlay material, and shedding of the excess, may result in a wear of perhaps 0.0004in; from this point onwards the mechanism of the bearing differs from that of a lubricated bearing in that attenuation of the PTFE/lead mix causes momentary metal-to-metal contact; the heat thus generated causes the bearing mix to expand, extrude from the bronze mesh, and immediately smear over the point of contact. Journal wear is not normally measurable; wear of the bush may be of the order of 0.00025in per thousand hours. Minimum compressive yield strength of the bearing material is about 20 tons/sq in. In most applications it is desirable to prevent fatigue failure by choosing a design limit of some 4 tons/sq in, but where relative movement should be slight much higher loadings are possible. In one application a single DU bush loaded at 18 tons/sq in carries the full weight of a large turbojet while it is being installed in the airframe or removed. Coefficient of friction normally lies between 0.10 and 0.16, but at lower speeds and under more intense loading the value falls to about half as much, and there is no stiction.

Indicative of the long life at high loadings which these Glacier bearings can achieve are the following figures for relative wear when running on a mild-steel shaft at a PV factor (lb/sq in multiplied by ft/min) of 16,000; when the rate of wear of DU is unity, other materials show the following figures: phenolic resin with MoS_2, 68; graphite/lead-bronze, 95; oil-impregnated porous bronze, 130; bearing-quality graphite, 208; woven asbestos impregnated with resin and MoS_2, 625; and nylon, 3,350.

Typical Glacier DU bushes and thrust washers



Initial and run-in structure of DU material (× 100)

All DU bearings are made as continuous strip, which is readily wrapped to form a bush or stamped out into thrust washers or hemispheres. Where more complex shapes are required Glacier have evolved DQ, a PTFE-filled homogeneous material which, although having poorer properties and performance than DU, can be moulded and machined.

Aeronautical applications of these bearings are too numerous to detail. The Avro 748, for example, has over 200, the majority relating to the flying-control surfaces and powerplant controls. Large numbers of DU bushes and thrust washers are employed in such aircraft as the Viscount, Comet, and Vanguard, the D.H.121 has DU bushes in the cable compensators and feel-spring struts on all three axes, and the largest of all DU bushes is a 10in unit specified for the main undercarriage strut of the VC10. The latest Rolls-Royce engines are full of DU or DQ items, and other applications include D.H. Propellers cold-air units and guided weapons and equipment by Aircraft Materials, Bristol Aircraft, Ekco, English Electric, Martin-Baker, Louis Newmark, Normalair, Teddington, and Teleflex. Glacier have licensees in France, Germany, Spain and the USA.

CIBA (A.R.L.) Changes

FOUNDER of Aero Research Ltd—now CIBA (A.R.L.) Ltd—Dr N. A. de Bruyne, MA, PhD, FInstP, FRAeS, is resigning from the managing directorship at the end of this year, though he will remain a member of the board. The company states that his resignation—at his own wish, as he wants to devote more time to research, particularly in the development of scientific instruments—has been "accepted with regret."

Dr de Bruyne

Mr Lea

Mr Hubbard

Educated at Lancing and Cambridge, Dr de Bruyne was in 1928 elected a Prize Fellow of Trinity College for his research work at the Cavendish Laboratory. In the following year he learned to fly, and his interest turned increasingly towards aircraft structures. He constructed and flew several machines; and in 1934, at his own expense, he built at Duxford a laboratory, hangar and landing ground. It was here that he established Aero Research Ltd and developed the Redux bonding process and various adhesives. The Swiss CIBA organization acquired control of the company in 1947, and its name was changed to CIBA (A.R.L.) in 1958.

On January 1 Mr R. F. G. Lea, OBE, MA, will become deputy chairman and, with Mr D. A. Hubbard, joint managing director. Mr Lea, who joined Aero Research in 1937 and was appointed to the board in 1946, served during the war with No 600 Sqn, RAuxAF, and was twice Mentioned in Despatches. Mr Hubbard joined the company in 1939 and the board in 1958. In charge of production throughout this period, he has been largely responsible for the planning of new urea-formaldehyde and epoxy resin plants.

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